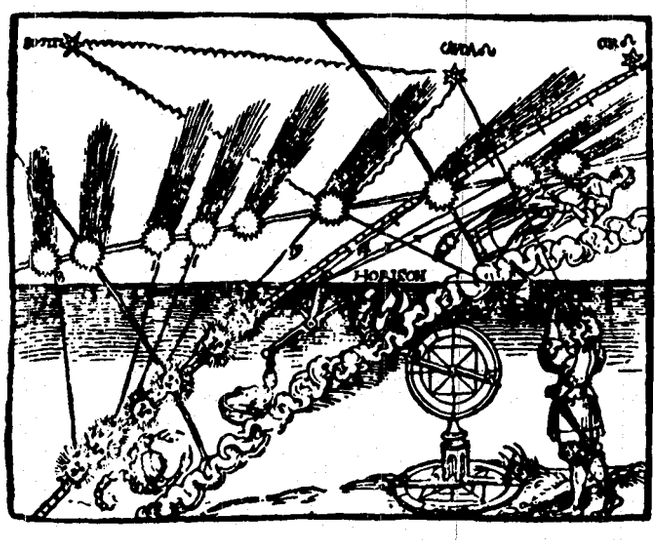
JPL PUBLICATION 83-16, PART II

International Halley Watch Amateur Observers' Manual for Scientific Comet Studies

Part II. Ephemeris and Star Charts

Stephen J. Edberg



March 1, 1983

NASA
National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

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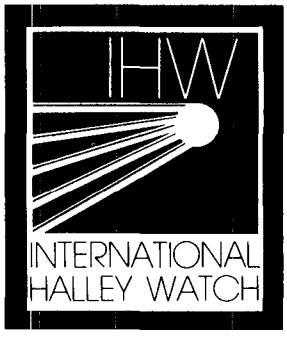

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Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

The research described in this manual was performed at the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.

ABSTRACT

This manual describes the International Halley Watch, comets and observing techniques, and provides information on periodic Comet Halley's apparition for its 1986 perihelion passage. Part I gives detailed instructions for observation projects valuable to the International Halley Watch in six areas of study: (1) visual observations, (2) photography, (3) astrometry, (4) spectroscopic observations, (5) photoelectric photometry, and (6) meteor observations. Part II includes an ephemeris for Comet Halley for the period 1985-1987 and star charts showing its position from November 1985 through May 1986.

FOREWORD

This manual has been written for the advanced amateur astronomer. Part I provides instructions on the proper methods of generating meaningful scientific data on comets. The novice can learn general observing techniques while learning the methods in this manual. Part II contains an ephemeris and star charts for finding the comet and making observations of it.

This manual does not teach basic observing, telescope adjustment, or data reduction techniques. There are many books available for such purposes. It should be stressed that the most important single thing an amateur can do to advance his skills is to use them. Practice provides part of the training necessary to advance in the techniques of skillful, scientific observing. Both novice and experienced observers should observe comets as they appear in preparation for Comet Halley's apparition in 1985-86.

It is a sad fact that many professional astronomers are unaware of the careful, professional-quality work which amateur astronomers are capable of and have, in some cases, been doing for years. There is now a movement to call people who practice astronomy without pay "nonprofessionals" in an effort to improve the image of the hardworking, dedicated amateur who does reputable research. While "amateur" and "nonprofessionals" are both accurate, the latter is less fluent and has not been used in the text. It is my hope that activities like the IHW Amateur Observation Net will demonstrate to professionals that their unpaid fellow astronomers--amateurs--are worthy of the respect sought with the "nonprofessional" noun.

Amateurs have made and can continue to make important contributions to cometary research. Dedication to the effort is all that's required.

S. E.

IHW AMATEUR OBSERVER'S MANUAL

Part II - Ephemeris and Charts

CONTENTS

1. REPORT FORM SAMPLES AND GLOSSARY OF TERMS

Report Form Samples

The following sample forms are included in Part II:

- Observer Index
- Visual Observations
- Drawing
- Photography
- Astrometry
- Spectroscopic Observations
- Photoelectric Photometry
- Visual Meteor Observations
- Meteor Photography

OBSERVER INDEX

Please tear out this form and fill it in as completely as possible if you plan to submit observations to the IHW. Also fill in the duplicate in Part II for your own records. It is important to read Sections 2 and 4 and the section describing your area of participation in Part I of this manual before submitting this index form. Return this form to Stephen Edberg (Jet Propulsion Laboratory, 4800 Oak Grove Dr., T-1166, Pasadena, California 91109, USA).

Name (Last, First) _____ Telephone:

Mailing Address _____ Day _____
area code + number

_____

_____ Night _____
area code + number

_____

Areas of Participation: (check all that apply)

___ Visual Observations
___ Photography
___ Astrometry
___ Spectroscopic Observations
___ Photoelectric Photometry
___ Meteor Studies

List Regular Observation Site(s). Longitude, latitude, and altitude may be determined using topographic maps.

Name	Longitude	Latitude	Altitude
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____

Provide the information requested on telescopes you expect to use including the units of measurement. Indicate the site numbers (from the list above) where the telescope has a permanent mount or where a portable mount is regularly used for visual (V), photographic (PG), and/or photoelectric (PE) observing. Binoculars users should state the power and aperture (e.g., 7x50) with the word binoculars under telescope type and skip the next two columns. Meteor observers should write meteor and visual, photographic, or radio under telescope type and give the site numbers where these observations are usually made.

Telescope Type	Aperture	Focal Length	Mounting Site # Perm.	Port.	Observing V	PG	PE
_____	_____	_____	_____	_____	_	_	_
_____	_____	_____	_____	_____	_	_	_
_____	_____	_____	_____	_____	_	_	_
_____	_____	_____	_____	_____	_	_	_

List equipment planned for use in photography not already listed as a telescope. This can include Schmidt or aerial cameras or interchangeable lenses belonging to your photographic system.

Camera	Focal Length	f/ratio	Notes

Photometric Equipment:

Photomultiplier Tube _____ Cooled ____ Uncooled ____

Electronics: Photon Counting _____ Analog _____

Miscellaneous Accessories:

Diffraction Grating Source or Manufacturer _____

_____ gr/mm, blaze order _____

Prism: Glass Type _____ Apex Angle _____

Rotating Meteor Shutter Chop Rate _____

I understand that the data I contribute to the International Halley Watch may be used by IHW Archive users and that my contribution will be acknowledged in the usual manner in any publications resulting from such use. I understand that I may also publish my data in any manner I choose.

_____
Signature Date

	Novice	Moderate	Expert
Level of Observational Experience	_____	_____	_____
General Astronomical Observations	_____	_____	_____
Comet Observations	_____	_____	_____
Meteor Observations	_____	_____	_____

Are you planning on traveling to the southern hemisphere to observe Halley's Comet in March or April 1986? Yes ___ No___

Additional Comments:

VISUAL OBSERVATION REPORT FORM

Observer _____

UT Date and Time	M. M.	Coma (Total) Magnitude	Chart No.	Instrument			Magnification	Coma Dia.	D.C.	Tail Length	PA	Faintest Star	Dark Adapted	Site	Notes
				Aperture	Type	f/									

DRAWING INFORMATION REPORT FORM

UT Date _____ Observer _____

Faintest Star _____ Site _____

Instrument Aperture _____ Type _____ f/_____

Seeing _____

UT Start _____ UT End _____

Magnification(s) Used _____

Filter(s) Used _____

Features	Type	ID#	PA

Indicate the orientation (north and east) in the drawing and the scale (minutes of arc per millimeter).

Notes:

PHOTOGRAPHIC INFORMATION REPORT FORM

UT Date Range _____ Observer _____

Instrument Focal Length _____ f/ _____

Photographic Method: PF ___ NP ___ EP ___ A ___ EFL = _____ mm

Film Name _____ ISO (ASA/DIN) _____

Hypersensitized in _____ at ____ °C °F for ____ hours

Emulsion cooled to ____ °C °F

Developed in _____ at ____ °C °F for ____ minutes

Guiding: Computed ___ Micrometer ___ On Condensation ___

Tangent X-hairs ___ X-hairs on Coma ___

Exposures

Negative Number	UT Date	UT Start	Duration	Filter	Faintest Star	Site

Notes:

Submit contact prints or duplicate slides with your name on them to the Photography Recorder.

ASTROMETRIC DATA REPORT FORM

UT Date Range _____ Observer _____

Instrument Focal Length _____ f/ _____

Photographic Method: PF ___ NP ___ EP ___ A ___ EFL = _____ mm

Film Name _____ ISO (ASA/DIN) _____

Hypersensitized in _____ at ____ °C °F for ____ hours

Emulsion cooled to ____ °C °F

Developed in _____ at ____ °C °F for ____ minutes

Guiding: Computed ___ Micrometer ___ On Condensation ___

Tangent X-hairs ___ X-hairs on Coma ___

Exposures

Negative #	UT Date	UT of Mid-Exposure	Duration	Site	Computed α	Computed δ	Comet Image

Notes:

Submit this form to the Coordinator for Amateur Observations.

SPECTROSCOPIC OBSERVATION REPORT FORM

(Use separate report forms for different spectroscopic methods.)

UT Date Range _____ Observer _____

Telescope Type _____ Aperture _____ Focal Length _____
or
Camera Lens Focal Length _____ f/_____

Objective _____ Nonobjective _____ Slitless _____

Film Name _____ ISO (ASA/DIN) _____

Hypersensitized in _____ at ____ °C °F for ____ hours

Emulsion cooled to ____ °C °F

Developed in _____ at ____ °C °F for ___ minutes

Guiding: Computed ____ Micrometer ____ On Condensation ____

Tangent X-hairs ____ X-hairs on Coma ____

Grating _____ gr/mm, blaze order _____.

Projection Distance _____ mm

Prism Apex Angle ____ ° Glass Type _____

Exposures

Negative Number	Comet or Star Designation	UT Date	UT Start	Duration	Faintest Star	Site

Notes:

Submit contact prints or duplicate slides with your name on them to the Photography Recorder.

PHOTOELECTRIC PHOTOMETRY REPORT FORM

UT Date _____ Observer _____

Site _____

Telescope Type _____ Aperture _____ Focal Length _____

Photometer: Detector Type _____ Cooled ___ Uncooled ___

Amplifier Type _____

Recording System: Analog _____ Digital_____

Detector Voltage _____ Amplifier Gain _____

N.D. Filter Used On Stellar Standards? Yes ___ No ___

Portion of Comet Observed _____

_____

Data are Raw ___ Reduced ___

Object	Diaphragm	Filter[1]	UT Start - End	Air Mass	Counts[2]

Notes

_____

[1] Attach a copy of transmission curves for any nonstandard filters used. This only needs to be done once, when the first report of its use is submitted.

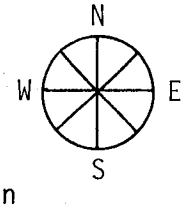
[2] For raw data from a strip chart recorder, this would be the fraction of full scale to three decimals. For reduced data, the results should be in magnitudes or absolute MKS units (Wm^{-2}).

VISUAL METEOR OBSERVATION REPORT FORM

UT Date _____ Observer _____

Dark Adaptation Time _____ Site _____

Cloud Cover



Count Method: Written _____

Counter _____

Tape Recorder _____

Facing Direction _____ Group Observation? Yes ___ No ___

Viewing Area of Sky: Unrestricted ___ Limited to ___ ° x ___°

UT Start	UT End	Faintest Star	Number of Meteors: Shower	Number of Meteors: Non-shower

Notes:

METEOR PHOTOGRAPHY INFORMATION REPORT FORM

UT Date Range _____ Observer _____

Camera Lens Focal Length _____ f/_____

Film Name _____ ISO (ASA/DIN) _____

Developed in _____ at ____ °C / °F for ____ minutes

Grating _____ gr/mm, blaze order _____.

Prism apex angle ____ ° Glass Type _____

Rotating Shutter Chop Frequency _____ . Other Chopper Info.: _____

_____

Exposures

Negative Number	Meteor or Star Designation	UT Date	UT Start	Duration	Faintest Star	Site

Triangulation: Second Observer _____

Second Site _____

Paired Negative Numbers _____

_____

(A separate report form should be completed for the second site.)

Notes:

Submit contact prints or duplicate slides with your name on them to the Meteor Recorder.

Comprehensive Report Form Explanation

Air Mass - Give the computed number of air masses through which the observation was made.

Camera Lens Focal Length and f/ - Focal length in mm and focal ratio (f/#) of the camera lens used.

Chart No. - The number of the IHW amateur manual's chart (not page number) used for comparison stars.

Cloud Cover - Sketch in the approximate amount of cloud cover in each octant of the sky. Note the cloud type or thickness.

Coma Dia. - The coma diameter observed in minutes of arc. Give the long and short dimensions of an elliptical coma.

Coma (Total) Magnitude - The coma's estimated magnitude; should be reported to the nearest 0.1 magnitude. If the magnitude is based on stars whose magnitudes are underlined, underline your estimate.

Comet Image - Note whether or not the measured comet image was diffuse or had an obvious central condensation. The discussion of degree of condensation in the Visual Observations section may be instructive.

Comet or Star Designation - Indicate if the negative has a spectrum of the comet or of a calibration star. If it is a stellar spectrum, give the name or right ascension and declination of the star.

Count Method - Indicate the method used for keeping the meteor count.

Counts - For raw data from a strip chart recorder, this would be the fraction of full scale to three decimals. For reduced data, the results should be in magnitudes or absolute MKS units (Wm^{-2}).

Dark Adaptation Time - State how long your eyes have had to dark adapt before beginning your visual observations. (A minimum of 20 minutes is necessary.)

Dark Adapted - Indicate Y (yes) or N (no) if you were dark adapted when the comet observation was made.

Data - Indicate if the data listed in the table are raw or reduced.

D.C. - Give the degree of condensation of the coma.

Diaphragm - List the diameter in seconds of arc of the photoelectric photometer diaphragm used.

Duration - Give the exposure time in minutes and tenths of minutes for long exposures and in seconds for short exposures.

EFL - Give the effective focal length of the photographic method used.

Facing Direction - Give the approximate direction faced (e.g., NW, SSE, WSW, S, etc.)

Faintest Star - Give the magnitude of the faintest star visible to the naked eye (to within 0.5 magnitude) on the star chart in Part II containing the comet's position for the night of observation. For meteor observations give the magnitude of the faintest star visible to the naked eye (to within 0.5 magnitude) in the center of the meteor field of view at the beginning and end of each meteor count period. M, T, C, or Z should be included with the stellar magnitude when moonlight, twilight, city lights, or zodiacal light (Table 3-1), respectively, interfere with the observation.

Film Name - The manufacturer and film type should be listed as well as the ISO (ASA/DIN). If the film has been hypersensitized, give the method (dry nitrogen, forming gas, silver nitrate rinse, alcohol rinse, etc.), the temperature of the solution, and the duration of the soak. For cooled emulsion photography, give the temperature at which the exposure was made. Indicate the applicable temperature scale. The film processing method should include developer, temperature, and time (or write "commercial" if processed professionally).

Filter - Give the name or transmission characteristics of the filter used or list the color and designation of the filter. Examples are Yellow, Wratten 12; Light Blue, Schott BG 38; etc. For Schott, Corning, and similar filters, include the thickness of the glass. For polarizing filters, give the position angle (PA) of the transmitted polarization on the sky. PA is defined to be 0° for due north and increases through 90° due east, 180° due south, and 270° due west. In the field of view, with the clock drive off, the last piece of an object drifting out of the field is the eastern piece. Thus, PA is well-defined even in circumpolar regions of the sky.

Filter(s) Used - List the filters used when the drawing was made.

Grating - Give the number of grooves per millimeter of the grating and the order or wavelength for which it is blazed.

Group Observation - Check Yes or No. If Yes, include the names of other observers in the group in the "Notes" section. Meteor counts must be reported individually and on an hourly basis.

Guiding - Indicate the guiding method used (see the Photography section for detailed descriptions).

Instrument - For Aperture, give the objective diameter in centimeters. Type describes the optical system (refractor, Newtonian, Cassegrain, Schmidt-Cassegrain, binoculars, etc.), and f/ is the focal ratio of the instrument.

Instrument Focal Length and f/ - Focal length in mm and focal ratio (f/#) of the instrument used.

Magnification - Found by dividing the telescope focal length by the focal length of the eyepiece used for the observation.

Magnification(s) Used - List the magnification(s) used when the drawing was made.

Meteor or Star Designation - Indicate if the negative has a spectrum of an η Aquarid or Orionid meteor or of a calibration star. Spectra of nonshower meteors may also be submitted and should be designated "nonshower." If the spectrum is from a star give the name or right ascension and declination of the star.

M.M. - The magnitude estimation method used:

B = Bobrovnikoff, S = Sidgwick, M = Morris

Negative Number - Give the number of the negative to which the exposure details apply.

Notes - Include further explanation for the Comet Image classification, if necessary, and comments on special circumstances, unusual events, exceptions, and deviations recognized during the observation or in the methods used to make the observation or to do the data reduction.

Number of Meteors - Give the number of shower meteors and nonshower meteors observed during the period of observation.

Object - State whether the data are for the comet, sky, dark current, or a comparison star. For a comparison star, identify it from the list of standard stars.

Objective, Nonobjective, or Slitless - Check the method of spectroscopy used.

Observed α, Observed δ - Give the right ascension (α) to two decimal places in seconds of time and declination (δ) to one decimal place in seconds of arc computed for the comet's position for the UT date and time of mid-exposure.

Observer - Each individual observer should use his/her own observing report form, complete with his/her name.

PA - Position angle of tail(s). For a curved tail give the distance from the nucleus where the measurement applies. Give the method used for determining it (plot, clock face, calibrated eyepiece). PA is defined to be 0° for due north and increases through 90° due east, 180° due south, and 270° due west. In the field of view, with the clock drive off, the last piece of an object drifting out of the field is the eastern piece. Thus, PA is well-defined even in circumpolar regions of the sky.

Photometer - Give the requested information on your photometer.

Photographic Method - Indicate the type based on the following light paths:

Principal Focus (PF): telescope objective - film
Negative Projection (NP): telescope objective - negative lens - film
Eyepiece Projection (EP): telescope objective - eyepiece - film
Afocal (A): telescope objective - eyepiece - camera lens - film

Portion of Comet Observed - Supply a complete description of the position of the diaphragm on the comet.

Prism - Give the angle in degrees between the two prism faces used to make the spectrum and the glass type, if known.

Projection Distance - For nonobjective spectroscopy give the distance from the ruled grating surface or prism face to the film.

Rotating Shutter Chop Frequency; Other Chopper Information - Give the number of breaks per second made by the chopper; give any other relevant details regarding the chopper.

Seeing - Estimation of the seeing quality in seconds of arc or describe the seeing in some other standard manner.

Site - Give the name of your observing site used for the reported obervation. If the site is not one listed on your Observer Index form, include the longitude, latitude, and altitude. Longitude, latitude and altitude are available on topographic maps available at appropriate government offices and some sporting goods and map stores. If these coordinates are not available give the nearest town, village, or major landmark and its distance and direction from the site.

Tail Length - Reported in degrees and tenths of degrees. Use two lines if two tails are visible.

Telescope - Give the telescope type, objective diameter, and focal length. For spectroscopic observations this needs to be filled in only if the nonobjective or slitless spectroscopic methods are used.

Triangulation: Second Observer, Second Site, Paired Negatives - Give the other observer's name, the other site's name and geographic location, and the number of the pairs of negatives containing the same meteor from the two sites.

UT Date - Give the date based on Universal Time.

UT Date and Time - Local dates and times should be converted to UT as explained in the Universal Time subsection, p. 4-6. Times given in UT should be accurate to ± 5 minutes. A decimal date (e.g., Nov. 12, 12:00 UT = Nov. 12.50 UT) can be included if desired. Decimal dates should be accurate to ±0.005 day.

UT Date Range - Give the first and last UT dates included for the photographs or spectrograms described on the report form.

UT of Mid-Exposure - Give the Universal Time of the middle of the photographic exposure, accurate to 1 second.

UT Start - End - Give the Universal Time of the start/end of the observation.

Viewing Area of Sky - Indicate unlimited or give the size of the area being concentrated on.

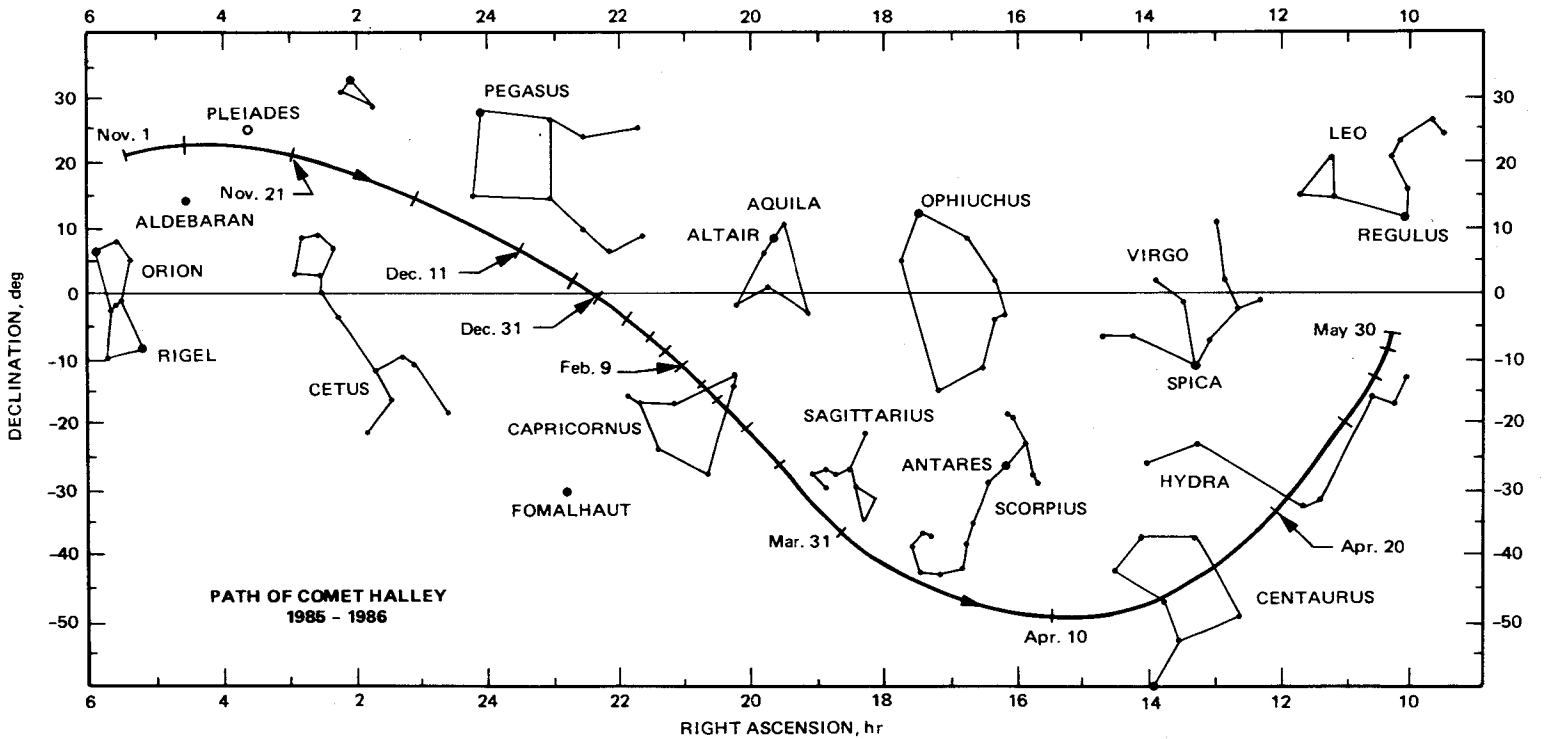
2. SELECTED EPHEMERIS DATA

FROM

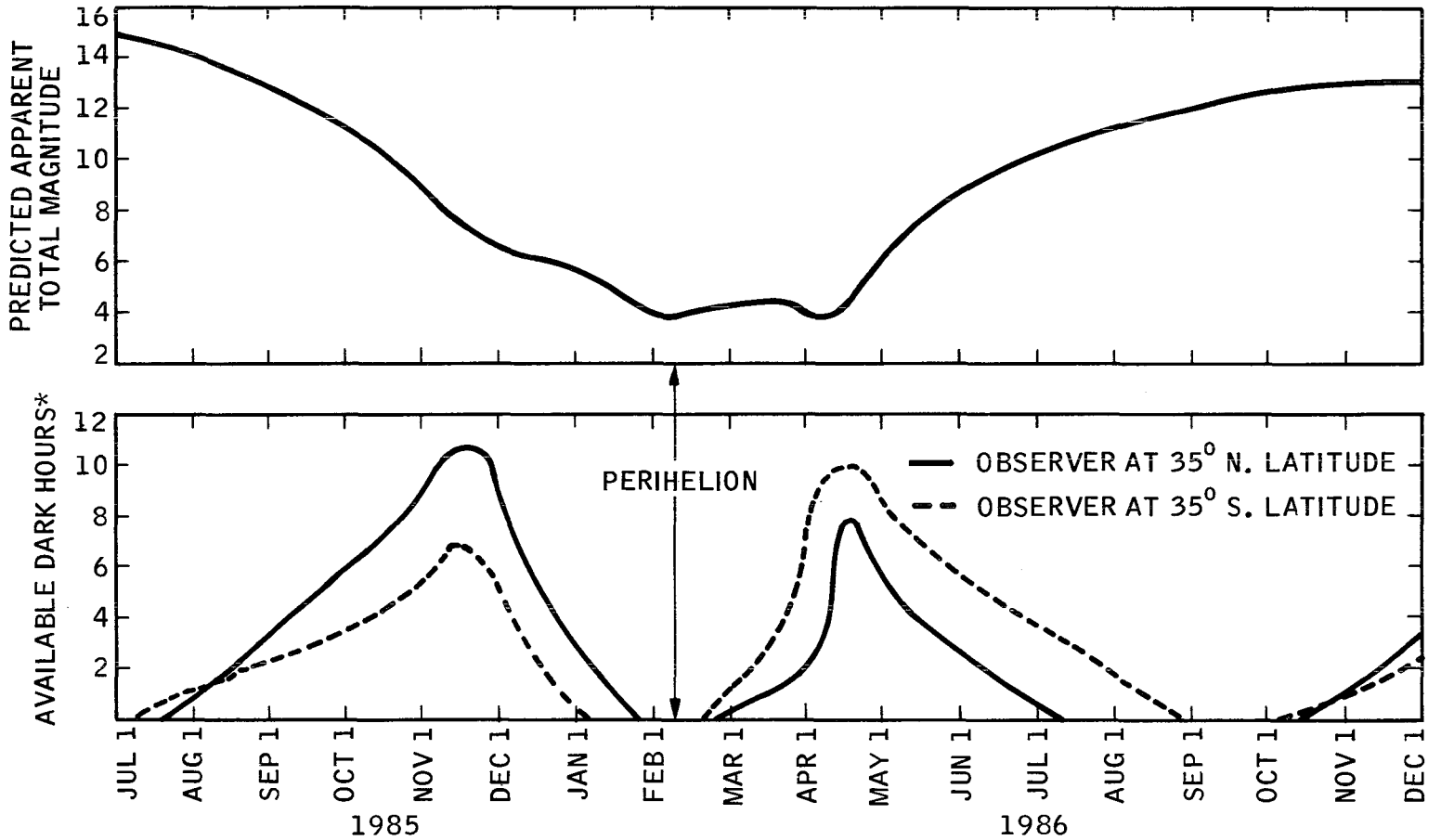
The Comet Halley Handbook
(second edition)

BY

DONALD K. YEOMANS



Path of Comet Halley on the Celestial Sphere During November 1985-May 1986



* NUMBER OF HOURS WHEN COMET IS ABOVE, AND SUN IS MORE THAN 18° BELOW, THE LOCAL HORIZON

Comet Halley 1985-1986 Ground-Based Observing Conditions

Ground-Based Observing Data, COMET HALLEY 1985-1986

Date (1985)	Dark Hours: North Lat. 45°	Dark Hours: North Lat. 30°	Dark Hours: South Lat. 30°	Dark Hours: South Lat. 45°	Apparent Magnitudes M_1	Date (1986)	Dark Hours: North Lat. 45°	Dark Hours: North Lat. 30°	Dark Hours: South Lat. 30°	Dark Hours: South Lat. 45°	Apparent Magnitudes M_1
Jan. 1	11.6	10.9	6.8	3.5	16.7	Jan. 6	2.6	2.3	0.5	0	5.6
11	10.7	10.0	6.9	3.9	16.6	16	1.3	1.1	0	0	5.1
21	9.7	9.1	7.2	4.6	16.5	26	0	0	0	0	4.4
31	8.7	8.1	5.6	5.3	16.4	Feb. 5	0	0	0	0	3.9
Feb. 10	7.7	7.2	5.0	3.7	16.4	15	0	0	0	0	4.1
20	6.8	6.4	4.4	3.3	16.3	25	0	0.3	0.7	0.5	4.3
Mar. 2	5.8	5.5	3.9	2.9	16.2	Mar. 7	0.2	0.9	2.0	5.0	4.5
12	4.9	4.7	3.4	2.5	16.2	17	0.5	1.5	3.3	3.7	4.5
22	4.0	4.0	2.9	2.1	16.1	27	0.7	2.3	5.3	6.2	4.3
Apr. 1	3.2	3.2	2.4	1.8	16.0	Apr. 6	0	3.8	9.1	9.4	4.0
11	2.3	2.5	1.9	1.4	15.9	16	6.0	8.3	10.0	9.9	4.4
21	1.4	1.7	1.5	1.0	15.9	26	6.2	8.0	9.2	10.0	5.5
May 1	0.5	1.0	1.0	0.6	15.7	May 6	5.5	5.1	7.7	8.3	6.6
11	0	0.3	0.5	0.2	15.6	16	2.7	4.3	6.7	7.3	7.5
21	0	0	0	0	15.5	26	1.9	3.5	6.0	6.5	8.3
31	0	0	0	0	15.3	Jun. 5	1.0	2.8	5.3	5.8	8.9
Jun. 10	0	0	0	0	15.1	15	0.2	2.1	4.6	5.1	9.4
20	0	0	0	0	14.9	25	0	1.5	4.0	4.5	9.9
30	0	0	0	0	14.7	Jul. 5	0	0.9	3.4	3.9	10.3
Jul. 10	0	0	0.3	0.1	14.5	15	0	0.4	2.7	3.2	10.7
20	0	0.5	0.8	0.5	14.2	25	0	0	2.1	2.5	11.0
30	0.5	1.2	1.3	0.9	13.9	Aug. 4	0	0	1.5	1.9	11.3
Aug. 9	1.4	1.9	1.7	1.3	13.6	14	0	0	0.9	1.2	11.6
19	2.3	2.6	2.1	1.6	13.2	24	0	0	0.3	0.5	11.8
29	3.2	3.3	2.5	1.9	12.8	Sep. 3	0	0	0	0	12.0
Sep. 8	4.1	4.0	2.9	2.2	12.4	13	0	0	0	0	12.2
18	5.0	4.8	3.3	2.5	11.9	23	0	0	0	0	12.3
28	5.9	5.6	3.8	2.8	11.3	Oct. 3	0	0	0	0	12.5
Oct. 8	6.9	6.4	4.3	3.1	10.7	13	0	0.1	0.4	0	12.6
18	8.0	7.3	4.9	3.5	10.0	23	0.4	0.8	0.8	0.4	12.7
28	9.2	8.5	5.7	4.1	9.1	Nov. 2	1.2	1.5	1.2	0.7	12.8
Nov. 7	10.7	10.0	6.8	5.0	8.2	12	2.0	2.2	1.7	1.0	12.9
17	11.1	10.6	7.3	4.9	7.2	22	2.7	2.8	2.3	1.4	13.0
27	10.6	9.8	7.0	4.2	6.5						
Dec. 7	7.7	7.1	4.4	3.6	6.3						
17	5.5	5.1	2.8	1.0	6.2						
27	3.9	3.6	1.5	0	6.0						

Note: (1) For a particular observer's latitude, the number of dark hours is defined as the time interval during which the Sun is below the local horizon by at least 18° and the comet is simultaneously above the local horizon.

(2) Magnitude estimates are based upon the comet's observed behavior in 1909–1910. Predictions are for ideal observing conditions.

Explanation of Symbols for Ephemeris

J.D. = Julian Date (Ephemeris Time)

R.A. 1950.0 DEC. = Geocentric right ascension and declination referred to the mean equator and equinox of 1950.0. A light time correction has been applied.

R.A. APPN DEC. = Apparent geocentric right ascension and declination. Light time, annual aberration, and nutation corrections have been applied, and R.A. and Dec. have been precessed to the ephemeris date.

DELTA = Geocentric distance of comet in AU.

DELDOT = Geocentric velocity of comet in km/sec.

R = Heliocentric distance of comet in AU.

RDOT = Heliocentric velocity of comet in km/sec.

M_1 = Total magnitude = 5.47 + 5.0 log (DELTA) + 11.1 log (R), preperihelion. Postperihelion, the corresponding equation is total magnitude = 4.94 + 5.0 log (DELTA) + 7.68 log (R).

M_2 = Nuclear magnitude = 14.1 + 5.0 log (DELTA) + 5.0 log (R).

NOTE: In cases where M_1 is not computed, the corresponding column is filled with zeros (.0)

THETA = Sun-Earth-Comet angle in degrees.

BETA = Sun-Comet-Earth angle in degrees.

MOON = Comet-Earth-Moon angle in degrees.

NOTES: 1. The following osculating orbital elements are consistent with the following ephermeris:

Epoch	2446480.50000	1986 FEB. 19.00000 (E.T.)
Perihelion Passage	2446470.95174	1986 FEB. 9.45174 (E.T.)
Perihelion Distance in AU	0.5871047	
Eccentricity	0.9672760	
Argument of Perihelion	111.84809	
Longitude of Ascending Node	58.14536	
Inclination	162.23928	

2. Angles are in degrees and are referred to the ecliptic and equinox of 1950.0.

3. The style II nongravitational parameters are:

$A_1 = (0.0565 \pm 0.0213) \times 10^{-8}$ AU/(day)^2

$A_2 = (0.0154 \pm 0.0001) \times 10^{-8}$ AU/(day)^2

YR	MN	DY	HR	J.D.	R.A. (1950)	DEC.	R.A.	APPN	DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1985	6	4	.0	2446220.5	5 15.148	+17 25.97	5 17.168	+17	28.27	4.76	-14.89	3.76	-18.72	15.2	20.4	8.5	2.3	170
1985	6	5	.0	2446221.5	5 15.736	+17 27.98	5 17.757	+17	30.25	4.75	-15.36	3.75	-18.74	15.2	20.3	7.9	2.1	158
1985	6	6	.0	2446222.5	5 16.328	+17 29.97	5 18.349	+17	32.21	4.74	-15.83	3.73	-18.77	15.2	20.3	7.3	2.0	145
1985	6	7	.0	2446223.5	5 16.924	+17 31.94	5 18.946	+17	34.15	4.73	-16.31	3.72	-18.79	15.2	20.3	6.8	1.9	132
1985	6	8	.0	2446224.5	5 17.523	+17 33.89	5 19.546	+17	36.08	4.72	-16.79	3.71	-18.82	15.2	20.3	6.3	1.7	119
1985	6	9	.0	2446225.5	5 18.126	+17 35.83	5 20.150	+17	37.99	4.71	-17.26	3.70	-18.84	15.1	20.3	6.0	1.6	107
1985	6	10	.0	2446226.5	5 18.732	+17 37.75	5 20.757	+17	39.88	4.70	-17.74	3.69	-18.87	15.1	20.3	5.7	1.6	95
1985	6	11	.0	2446227.5	5 19.342	+17 39.66	5 21.367	+17	41.75	4.69	-18.22	3.68	-18.90	15.1	20.3	5.5	1.5	83
1985	6	12	.0	2446228.5	5 19.956	+17 41.54	5 21.981	+17	43.61	4.68	-18.70	3.67	-18.92	15.1	20.3	5.4	1.5	71
1985	6	13	.0	2446229.5	5 20.572	+17 43.41	5 22.598	+17	45.44	4.67	-19.17	3.66	-18.95	15.1	20.3	5.5	1.5	60
1985	6	14	.0	2446230.5	5 21.192	+17 45.26	5 23.219	+17	47.26	4.66	-19.65	3.65	-18.97	15.0	20.2	5.6	1.6	48
1985	6	15	.0	2446231.5	5 21.814	+17 47.09	5 23.842	+17	49.06	4.65	-20.13	3.64	-19.00	15.0	20.2	5.9	1.6	37
1985	6	16	.0	2446232.5	5 22.440	+17 48.90	5 24.468	+17	50.84	4.63	-20.61	3.63	-19.03	15.0	20.2	6.3	1.8	26
1985	6	17	.0	2446233.5	5 23.068	+17 50.69	5 25.097	+17	52.61	4.62	-21.09	3.61	-19.05	15.0	20.2	6.7	1.9	15
1985	6	18	.0	2446234.5	5 23.699	+17 52.47	5 25.729	+17	54.35	4.61	-21.56	3.60	-19.08	15.0	20.2	7.2	2.0	8
1985	6	19	.0	2446235.5	5 24.331	+17 54.23	5 26.363	+17	56.08	4.60	-22.04	3.59	-19.11	14.9	20.2	7.8	2.2	14
1985	6	20	.0	2446236.5	5 24.967	+17 55.97	5 26.999	+17	57.79	4.58	-22.52	3.58	-19.13	14.9	20.2	8.3	2.4	25
1985	6	21	.0	2446237.5	5 25.605	+17 57.69	5 27.638	+17	59.48	4.57	-22.99	3.57	-19.16	14.9	20.2	9.0	2.5	37
1985	6	22	.0	2446238.5	5 26.244	+17 59.39	5 28.278	+18	1.15	4.56	-23.47	3.56	-19.19	14.9	20.1	9.6	2.7	50
1985	6	23	.0	2446239.5	5 26.886	+18 1.07	5 28.921	+18	2.80	4.54	-23.94	3.55	-19.22	14.9	20.1	10.3	2.9	63
1985	6	24	.0	2446240.5	5 27.530	+18 2.74	5 29.565	+18	4.43	4.53	-24.41	3.54	-19.24	14.8	20.1	11.0	3.1	76
1985	6	25	.0	2446241.5	5 28.175	+18 4.38	5 30.211	+18	6.04	4.51	-24.88	3.53	-19.27	14.8	20.1	11.7	3.3	90
1985	6	26	.0	2446242.5	5 28.822	+18 6.01	5 30.858	+18	7.64	4.50	-25.35	3.51	-19.30	14.8	20.1	12.4	3.6	103
1985	6	27	.0	2446243.5	5 29.470	+18 7.61	5 31.507	+18	9.22	4.49	-25.81	3.50	-19.33	14.8	20.1	13.1	3.8	117
1985	6	28	.0	2446244.5	5 30.120	+18 9.20	5 32.158	+18	10.77	4.47	-26.28	3.49	-19.35	14.8	20.1	13.8	4.0	131
1985	6	29	.0	2446245.5	5 30.771	+18 10.77	5 32.809	+18	12.31	4.46	-26.74	3.48	-19.38	14.7	20.1	14.6	4.2	145
1985	6	30	.0	2446246.5	5 31.423	+18 12.33	5 33.462	+18	13.83	4.44	-27.20	3.47	-19.41	14.7	20.0	15.3	4.4	159
1985	7	1	.0	2446247.5	5 32.076	+18 13.86	5 34.116	+18	15.33	4.42	-27.66	3.46	-19.44	14.7	20.0	16.1	4.7	170
1985	7	2	.0	2446248.5	5 32.730	+18 15.38	5 34.771	+18	16.81	4.41	-28.12	3.45	-19.47	14.7	20.0	16.8	4.9	167
1985	7	3	.0	2446249.5	5 33.385	+18 16.87	5 35.427	+18	18.28	4.39	-28.57	3.44	-19.50	14.6	20.0	17.6	5.1	155
1985	7	4	.0	2446250.5	5 34.040	+18 18.35	5 36.083	+18	19.73	4.37	-29.03	3.42	-19.53	14.6	20.0	18.3	5.4	142
1985	7	5	.0	2446251.5	5 34.697	+18 19.81	5 36.741	+18	21.15	4.36	-29.48	3.41	-19.55	14.6	20.0	19.1	5.6	129
1985	7	6	.0	2446252.5	5 35.353	+18 21.26	5 37.398	+18	22.57	4.34	-29.94	3.40	-19.58	14.6	19.9	19.9	5.8	116
1985	7	7	.0	2446253.5	5 36.011	+18 22.68	5 38.056	+18	23.96	4.32	-30.39	3.39	-19.61	14.5	19.9	20.6	6.1	103
1985	7	8	.0	2446254.5	5 36.669	+18 24.09	5 38.715	+18	25.33	4.31	-30.84	3.38	-19.64	14.5	19.9	21.4	6.3	91
1985	7	9	.0	2446255.5	5 37.326	+18 25.48	5 39.373	+18	26.69	4.29	-31.29	3.37	-19.67	14.5	19.9	22.2	6.5	79
1985	7	10	.0	2446256.5	5 37.984	+18 26.85	5 40.032	+18	28.03	4.27	-31.73	3.36	-19.70	14.5	19.9	22.9	6.8	68
1985	7	11	.0	2446257.5	5 38.642	+18 28.20	5 40.690	+18	29.35	4.25	-32.18	3.35	-19.73	14.4	19.9	23.7	7.0	56
1985	7	12	.0	2446258.5	5 39.300	+18 29.54	5 41.349	+18	30.66	4.23	-32.62	3.33	-19.76	14.4	19.8	24.5	7.3	45
1985	7	13	.0	2446259.5	5 39.957	+18 30.86	5 42.007	+18	31.94	4.21	-33.07	3.32	-19.79	14.4	19.8	25.3	7.5	33
1985	7	14	.0	2446260.5	5 40.614	+18 32.16	5 42.664	+18	33.21	4.19	-33.51	3.31	-19.82	14.4	19.8	26.0	7.7	22
1985	7	15	.0	2446261.5	5 41.270	+18 33.45	5 43.321	+18	34.46	4.17	-33.94	3.30	-19.85	14.3	19.8	26.8	8.0	12
1985	7	16	.0	2446262.5	5 41.926	+18 34.71	5 43.978	+18	35.69	4.15	-34.38	3.29	-19.88	14.3	19.8	27.6	8.2	8
1985	7	17	.0	2446263.5	5 42.580	+18 35.96	5 44.633	+18	36.91	4.13	-34.82	3.28	-19.91	14.3	19.8	28.4	8.5	17
1985	7	18	.0	2446264.5	5 43.234	+18 37.20	5 45.287	+18	38.11	4.11	-35.25	3.27	-19.95	14.2	19.7	29.2	8.7	29
1985	7	19	.0	2446265.5	5 43.886	+18 38.41	5 45.940	+18	39.30	4.09	-35.68	3.25	-19.98	14.2	19.7	30.0	9.0	42
1985	7	20	.0	2446266.5	5 44.537	+18 39.61	5 46.592	+18	40.47	4.07	-36.10	3.24	-20.01	14.2	19.7	30.7	9.2	55
1985	7	21	.0	2446267.5	5 45.186	+18 40.80	5 47.241	+18	41.62	4.05	-36.52	3.23	-20.04	14.2	19.7	31.5	9.5	69
1985	7	22	.0	2446268.5	5 45.833	+18 41.96	5 47.889	+18	42.76	4.03	-36.94	3.22	-20.07	14.1	19.7	32.3	9.7	82
1985	7	23	.0	2446269.5	5 46.479	+18 43.12	5 48.535	+18	43.88	4.01	-37.36	3.21	-20.10	14.1	19.6	33.1	10.0	96

YR	MN	DY	HR	J.D.	R.A. (1950)	DEC.	R.A. APPN	DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1985	7	24	.0	2446270.5	5 47.122	+18 44.25	5 49.179	+18 44.98	3.99	-37.77	3.20	-20.13	14.1	19.6	33.9	10.2	110
1985	7	25	.0	2446271.5	5 47.763	+18 45.37	5 49.821	+18 46.07	3.97	-38.18	3.18	-20.17	14.0	19.6	34.7	10.5	124
1985	7	26	.0	2446272.5	5 48.402	+18 46.48	5 50.461	+18 47.14	3.94	-38.59	3.17	-20.20	14.0	19.6	35.5	10.7	137
1985	7	27	.0	2446273.5	5 49.038	+18 47.57	5 51.098	+18 48.20	3.92	-38.99	3.16	-20.23	14.0	19.6	36.3	11.0	151
1985	7	28	.0	2446274.5	5 49.672	+18 48.65	5 51.732	+18 49.25	3.90	-39.39	3.15	-20.26	14.0	19.5	37.1	11.2	164
1985	7	29	.0	2446275.5	5 50.303	+18 49.72	5 52.364	+18 50.28	3.88	-39.79	3.14	-20.30	13.9	19.5	37.9	11.5	171
1985	7	30	.0	2446276.5	5 50.930	+18 50.77	5 52.992	+18 51.30	3.85	-40.18	3.13	-20.33	13.9	19.5	38.7	11.7	163
1985	7	31	.0	2446277.5	5 51.555	+18 51.81	5 53.618	+18 52.31	3.83	-40.57	3.11	-20.36	13.9	19.5	39.5	12.0	151
1985	8	1	.0	2446278.5	5 52.176	+18 52.83	5 54.240	+18 53.31	3.81	-40.95	3.10	-20.40	13.8	19.5	40.3	12.2	138
1985	8	2	.0	2446279.5	5 52.794	+18 53.85	5 54.859	+18 54.29	3.78	-41.34	3.09	-20.43	13.8	19.4	41.1	12.5	125
1985	8	3	.0	2446280.5	5 53.409	+18 54.85	5 55.474	+18 55.26	3.76	-41.72	3.08	-20.46	13.8	19.4	41.9	12.7	112
1985	8	4	.0	2446281.5	5 54.019	+18 55.84	5 56.085	+18 56.22	3.73	-42.10	3.07	-20.50	13.7	19.4	42.7	13.0	100
1985	8	5	.0	2446282.5	5 54.626	+18 56.82	5 56.692	+18 57.17	3.71	-42.47	3.05	-20.53	13.7	19.4	43.5	13.2	88
1985	8	6	.0	2446283.5	5 55.228	+18 57.79	5 57.295	+18 58.11	3.69	-42.85	3.04	-20.57	13.7	19.3	44.3	13.5	76
1985	8	7	.0	2446284.5	5 55.826	+18 58.75	5 57.893	+18 59.04	3.66	-43.22	3.03	-20.60	13.6	19.3	45.1	13.7	64
1985	8	8	.0	2446285.5	5 56.420	+18 59.70	5 58.487	+18 59.96	3.64	-43.58	3.02	-20.63	13.6	19.3	45.9	14.0	53
1985	8	9	.0	2446286.5	5 57.008	+19 .64	5 59.076	+19 .87	3.61	-43.95	3.01	-20.67	13.6	19.3	46.7	14.2	41
1985	8	10	.0	2446287.5	5 57.592	+19 1.57	5 59.661	+19 1.77	3.58	-44.31	3.00	-20.70	13.5	19.3	47.6	14.5	30
1985	8	11	.0	2446288.5	5 58.170	+19 2.49	6 .239	+19 2.66	3.56	-44.66	2.98	-20.74	13.5	19.2	48.4	14.7	19
1985	8	12	.0	2446289.5	5 58.742	+19 3.40	6 .813	+19 3.55	3.53	-45.02	2.97	-20.77	13.5	19.2	49.2	15.0	9
1985	8	13	.0	2446290.5	5 59.309	+19 4.31	6 1.380	+19 4.42	3.51	-45.36	2.96	-20.81	13.4	19.2	50.0	15.2	10
1985	8	14	.0	2446291.5	5 59.869	+19 5.21	6 1.941	+19 5.30	3.48	-45.71	2.95	-20.85	13.4	19.2	50.8	15.5	21
1985	8	15	.0	2446292.5	6 .424	+19 6.11	6 2.496	+19 6.16	3.45	-46.05	2.94	-20.88	13.4	19.1	51.7	15.7	34
1985	8	16	.0	2446293.5	6 .971	+19 6.99	6 3.045	+19 7.03	3.43	-46.39	2.92	-20.92	13.3	19.1	52.5	15.9	47
1985	8	17	.0	2446294.5	6 1.512	+19 7.88	6 3.586	+19 7.88	3.40	-46.72	2.91	-20.95	13.3	19.1	53.3	16.2	60
1985	8	18	.0	2446295.5	6 2.048	+19 8.76	6 4.120	+19 8.74	3.37	-47.04	2.90	-20.99	13.2	19.1	54.1	16.4	74
1985	8	19	.0	2446296.5	6 2.571	+19 9.64	6 4.646	+19 9.59	3.35	-47.36	2.89	-21.03	13.2	19.0	55.0	16.7	88
1985	8	20	.0	2446297.5	6 3.088	+19 10.51	6 5.164	+19 10.44	3.32	-47.68	2.87	-21.07	13.2	19.0	55.8	16.9	102
1985	8	21	.0	2446298.5	6 3.598	+19 11.38	6 5.674	+19 11.28	3.29	-47.99	2.86	-21.10	13.1	19.0	56.7	17.2	117
1985	8	22	.0	2446299.5	6 4.099	+19 12.26	6 6.176	+19 12.13	3.26	-48.30	2.85	-21.14	13.1	18.9	57.5	17.4	131
1985	8	23	.0	2446300.5	6 4.591	+19 13.13	6 6.668	+19 12.98	3.24	-48.60	2.84	-21.18	13.0	18.9	58.3	17.7	144
1985	8	24	.0	2446301.5	6 5.074	+19 14.00	6 7.152	+19 13.83	3.21	-48.89	2.83	-21.22	13.0	18.9	59.2	17.9	158
1985	8	25	.0	2446302.5	6 5.547	+19 14.88	6 7.627	+19 14.68	3.18	-49.18	2.81	-21.25	13.0	18.9	60.0	18.1	169
1985	8	26	.0	2446303.5	6 6.011	+19 15.76	6 8.091	+19 15.53	3.15	-49.47	2.80	-21.29	12.9	18.8	60.9	18.4	169
1985	8	27	.0	2446304.5	6 6.465	+19 16.64	6 8.545	+19 16.39	3.12	-49.75	2.79	-21.33	12.9	18.8	61.7	18.6	158
1985	8	28	.0	2446305.5	6 6.908	+19 17.53	6 8.989	+19 17.26	3.09	-50.03	2.78	-21.37	12.8	18.8	62.6	18.8	145
1985	8	29	.0	2446306.5	6 7.340	+19 18.42	6 9.422	+19 18.13	3.06	-50.30	2.76	-21.41	12.8	18.7	63.5	19.1	132
1985	8	30	.0	2446307.5	6 7.760	+19 19.32	6 9.843	+19 19.01	3.03	-50.57	2.75	-21.45	12.8	18.7	64.3	19.3	120
1985	8	31	.0	2446308.5	6 8.169	+19 20.23	6 10.253	+19 19.90	3.01	-50.83	2.74	-21.49	12.7	18.7	65.2	19.5	107
1985	9	1	.0	2446309.5	6 8.566	+19 21.15	6 10.650	+19 20.80	2.98	-51.09	2.73	-21.53	12.7	18.6	66.1	19.8	95
1985	9	2	.0	2446310.5	6 8.951	+19 22.07	6 11.035	+19 21.70	2.95	-51.34	2.71	-21.57	12.6	18.6	66.9	20.0	83
1985	9	3	.0	2446311.5	6 9.322	+19 23.01	6 11.407	+19 22.63	2.92	-51.59	2.70	-21.61	12.6	18.6	67.8	20.2	71
1985	9	4	.0	2446312.5	6 9.679	+19 23.97	6 11.765	+19 23.56	2.89	-51.83	2.69	-21.65	12.5	18.6	68.7	20.4	60
1985	9	5	.0	2446313.5	6 10.023	+19 24.93	6 12.109	+19 24.51	2.86	-52.07	2.68	-21.69	12.5	18.5	69.6	20.7	48
1985	9	6	.0	2446314.5	6 10.351	+19 25.92	6 12.438	+19 25.47	2.83	-52.30	2.66	-21.73	12.5	18.5	70.5	20.9	36
1985	9	7	.0	2446315.5	6 10.665	+19 26.92	6 12.753	+19 26.46	2.80	-52.52	2.65	-21.77	12.4	18.5	71.4	21.1	25
1985	9	8	.0	2446316.5	6 10.962	+19 27.93	6 13.051	+19 27.46	2.77	-52.74	2.64	-21.81	12.4	18.4	72.3	21.3	14
1985	9	9	.0	2446317.5	6 11.243	+19 28.97	6 13.332	+19 28.48	2.74	-52.96	2.63	-21.85	12.3	18.4	73.2	21.5	8
1985	9	10	.0	2446318.5	6 11.506	+19 30.03	6 13.597	+19 29.52	2.70	-53.17	2.61	-21.89	12.3	18.3	74.1	21.7	14
1985	9	11	.0	2446319.5	6 11.752	+19 31.11	6 13.843	+19 30.59	2.67	-53.37	2.60	-21.93	12.2	18.3	75.0	21.9	26

YR	MN	DY	HR	J.D.	R.A. (1950)	DEC.	R.A.	APPN	DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1985	9	12	.0	2446320.5	6 11.979	+19 32.22	6 14.071	+19	31.69	2.64	-53.57	2.59	-21.98	12.2	18.3	75.9	22.1	39
1985	9	13	.0	2446321.5	6 12.186	+19 33.35	6 14.279	+19	32.81	2.61	-53.75	2.58	-22.02	12.1	18.2	76.8	22.4	52
1985	9	14	.0	2446322.5	6 12.373	+19 34.51	6 14.467	+19	33.96	2.58	-53.94	2.56	-22.06	12.1	18.2	77.7	22.5	66
1985	9	15	.0	2446323.5	6 12.539	+19 35.70	6 14.633	+19	35.14	2.55	-54.11	2.55	-22.10	12.0	18.2	78.7	22.7	81
1985	9	16	.0	2446324.5	6 12.683	+19 36.92	6 14.778	+19	36.36	2.52	-54.28	2.54	-22.15	12.0	18.1	79.6	22.9	95
1985	9	17	.0	2446325.5	6 12.804	+19 38.17	6 14.899	+19	37.61	2.49	-54.44	2.53	-22.19	11.9	18.1	80.6	23.1	110
1985	9	18	.0	2446326.5	6 12.901	+19 39.47	6 14.997	+19	38.89	2.46	-54.59	2.51	-22.24	11.9	18.1	81.5	23.3	124
1985	9	19	.0	2446327.5	6 12.973	+19 40.80	6 15.070	+19	40.22	2.42	-54.73	2.50	-22.28	11.8	18.0	82.5	23.5	139
1985	9	20	.0	2446328.5	6 13.019	+19 42.17	6 15.118	+19	41.59	2.39	-54.86	2.49	-22.32	11.8	18.0	83.4	23.7	153
1985	9	21	.0	2446329.5	6 13.039	+19 43.58	6 15.138	+19	43.00	2.36	-54.99	2.47	-22.37	11.7	17.9	84.4	23.8	165
1985	9	22	.0	2446330.5	6 13.030	+19 45.04	6 15.131	+19	44.46	2.33	-55.11	2.46	-22.41	11.6	17.9	85.4	24.0	171
1985	9	23	.0	2446331.5	6 12.992	+19 46.55	6 15.094	+19	45.97	2.30	-55.22	2.45	-22.46	11.6	17.8	86.4	24.1	162
1985	9	24	.0	2446332.5	6 12.924	+19 48.11	6 15.027	+19	47.53	2.27	-55.32	2.43	-22.50	11.5	17.8	87.4	24.3	150
1985	9	25	.0	2446333.5	6 12.825	+19 49.72	6 14.928	+19	49.15	2.23	-55.41	2.42	-22.55	11.5	17.8	88.4	24.5	137
1985	9	26	.0	2446334.5	6 12.692	+19 51.39	6 14.797	+19	50.82	2.20	-55.50	2.41	-22.59	11.4	17.7	89.4	24.6	124
1985	9	27	.0	2446335.5	6 12.525	+19 53.11	6 14.630	+19	52.56	2.17	-55.58	2.40	-22.64	11.4	17.7	90.4	24.7	112
1985	9	28	.0	2446336.5	6 12.321	+19 54.90	6 14.428	+19	54.35	2.14	-55.65	2.38	-22.69	11.3	17.6	91.4	24.9	100
1985	9	29	.0	2446337.5	6 12.080	+19 56.75	6 14.188	+19	56.21	2.10	-55.71	2.37	-22.73	11.2	17.6	92.5	25.0	87
1985	9	30	.0	2446338.5	6 11.800	+19 58.66	6 13.908	+19	58.15	2.07	-55.76	2.36	-22.78	11.2	17.5	93.5	25.1	75
1985	10	1	.0	2446339.5	6 11.478	+20 .65	6 13.587	+20	.15	2.04	-55.80	2.34	-22.83	11.1	17.5	94.6	25.2	63
1985	10	2	.0	2446340.5	6 11.113	+20 2.71	6 13.223	+20	2.22	2.01	-55.83	2.33	-22.88	11.1	17.5	95.6	25.3	52
1985	10	3	.0	2446341.5	6 10.702	+20 4.84	6 12.814	+20	4.38	1.98	-55.85	2.32	-22.92	11.0	17.4	96.7	25.4	40
1985	10	4	.0	2446342.5	6 10.245	+20 7.06	6 12.357	+20	6.61	1.94	-55.86	2.30	-22.97	10.9	17.4	97.8	25.5	28
1985	10	5	.0	2446343.5	6 9.737	+20 9.35	6 11.851	+20	8.94	1.91	-55.86	2.29	-23.02	10.9	17.3	98.9	25.6	17
1985	10	6	.0	2446344.5	6 9.176	+20 11.73	6 11.292	+20	11.34	1.88	-55.85	2.28	-23.07	10.8	17.3	100.0	25.6	8
1985	10	7	.0	2446345.5	6 8.561	+20 14.20	6 10.678	+20	13.84	1.85	-55.83	2.26	-23.12	10.7	17.2	101.1	25.7	11
1985	10	8	.0	2446346.5	6 7.887	+20 16.76	6 10.006	+20	16.44	1.81	-55.79	2.25	-23.17	10.7	17.2	102.3	25.7	22
1985	10	9	.0	2446347.5	6 7.153	+20 19.42	6 9.272	+20	19.13	1.78	-55.74	2.24	-23.22	10.6	17.1	103.5	25.7	35
1985	10	10	.0	2446348.5	6 6.354	+20 22.17	6 8.475	+20	21.92	1.75	-55.68	2.22	-23.26	10.5	17.1	104.6	25.8	48
1985	10	11	.0	2446349.5	6 5.488	+20 25.02	6 7.610	+20	24.82	1.72	-55.60	2.21	-23.31	10.5	17.0	105.8	25.8	62
1985	10	12	.0	2446350.5	6 4.550	+20 27.97	6 6.673	+20	27.83	1.69	-55.50	2.20	-23.36	10.4	16.9	107.0	25.8	76
1985	10	13	.0	2446351.5	6 3.536	+20 31.04	6 5.661	+20	30.94	1.65	-55.39	2.18	-23.42	10.3	16.9	108.3	25.7	91
1985	10	14	.0	2446352.5	6 2.444	+20 34.21	6 4.570	+20	34.17	1.62	-55.26	2.17	-23.47	10.3	16.8	109.5	25.7	106
1985	10	15	.0	2446353.5	6 1.267	+20 37.49	6 3.395	+20	37.51	1.59	-55.12	2.16	-23.52	10.2	16.8	110.8	25.6	121
1985	10	16	.0	2446354.5	6 .002	+20 40.88	6 2.131	+20	40.97	1.56	-54.95	2.14	-23.57	10.1	16.7	112.1	25.5	136
1985	10	17	.0	2446355.5	5 58.643	+20 44.39	6 .774	+20	44.55	1.53	-54.77	2.13	-23.62	10.0	16.7	113.4	25.5	151
1985	10	18	.0	2446356.5	5 57.185	+20 48.02	5 59.318	+20	48.24	1.50	-54.56	2.11	-23.67	10.0	16.6	114.7	25.3	166
1985	10	19	.0	2446357.5	5 55.623	+20 51.76	5 57.757	+20	52.06	1.46	-54.33	2.10	-23.72	9.9	16.5	116.1	25.2	172
1985	10	20	.0	2446358.5	5 53.949	+20 55.61	5 56.086	+20	56.00	1.43	-54.08	2.09	-23.78	9.8	16.5	117.4	25.0	162
1985	10	21	.0	2446359.5	5 52.159	+20 59.57	5 54.297	+21	.06	1.40	-53.81	2.07	-23.83	9.7	16.4	118.9	24.9	148
1985	10	22	.0	2446360.5	5 50.244	+21 3.65	5 52.383	+21	4.24	1.37	-53.51	2.06	-23.88	9.6	16.4	120.3	24.7	135
1985	10	23	.0	2446361.5	5 48.197	+21 7.83	5 50.338	+21	8.52	1.34	-53.19	2.05	-23.94	9.6	16.3	121.8	24.4	122
1985	10	24	.0	2446362.5	5 46.009	+21 12.11	5 48.152	+21	12.91	1.31	-52.84	2.03	-23.99	9.5	16.2	123.3	24.2	109
1985	10	25	.0	2446363.5	5 43.673	+21 16.47	5 45.818	+21	17.40	1.28	-52.45	2.02	-24.04	9.4	16.2	124.8	23.9	96
1985	10	26	.0	2446364.5	5 41.179	+21 20.92	5 43.325	+21	21.98	1.25	-52.04	2.00	-24.10	9.3	16.1	126.4	23.5	83
1985	10	27	.0	2446365.5	5 38.517	+21 25.43	5 40.664	+21	26.63	1.22	-51.59	1.99	-24.15	9.2	16.0	128.0	23.2	71
1985	10	28	.0	2446366.5	5 35.675	+21 29.99	5 37.824	+21	31.33	1.19	-51.10	1.98	-24.20	9.1	16.0	129.7	22.8	58
1985	10	29	.0	2446367.5	5 32.644	+21 34.57	5 34.794	+21	36.07	1.16	-50.58	1.96	-24.26	9.0	15.9	131.4	22.3	46
1985	10	30	.0	2446368.5	5 29.409	+21 39.16	5 31.561	+21	40.82	1.13	-50.01	1.95	-24.31	9.0	15.8	133.1	21.8	33
1985	10	31	.0	2446369.5	5 25.960	+21 43.71	5 28.113	+21	45.55	1.10	-49.40	1.93	-24.37	8.9	15.7	134.9	21.3	21

YR	MN	DY	HR	J.D.	R.A. (1950)	DEC.	R.A. APPN	DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1985	11	1	.0	2446370.5	5 22.281	+21 48.18	5 24.435	+21 50.22	1.07	-48.73	1.92	-24.42	8.8	15.7	136.8	20.7	9
1985	11	2	.0	2446371.5	5 18.358	+21 52.55	5 20.513	+21 54.78	1.05	-48.02	1.91	-24.48	8.7	15.6	138.7	20.1	6
1985	11	3	.0	2446372.5	5 14.175	+21 56.73	5 16.331	+21 59.18	1.02	-47.24	1.89	-24.54	8.6	15.5	140.6	19.4	18
1985	11	4	.0	2446373.5	5 9.717	+22 .69	5 11.874	+22 3.36	.99	-46.40	1.88	-24.59	8.5	15.4	142.7	18.7	31
1985	11	5	.0	2446374.5	5 4.968	+22 4.33	5 7.124	+22 7.25	.96	-45.50	1.86	-24.65	8.4	15.4	144.7	17.9	44
1985	11	6	.0	2446375.5	4 59.909	+22 7.57	5 2.065	+22 10.74	.94	-44.52	1.85	-24.70	8.3	15.3	146.9	17.0	58
1985	11	7	.0	2446376.5	4 54.523	+22 10.30	4 56.679	+22 13.75	.91	-43.46	1.84	-24.76	8.2	15.2	149.2	16.1	72
1985	11	8	.0	2446377.5	4 48.793	+22 12.41	4 50.948	+22 16.15	.89	-42.32	1.82	-24.82	8.1	15.1	151.5	15.1	87
1985	11	9	.0	2446378.5	4 42.702	+22 13.77	4 44.854	+22 17.80	.86	-41.09	1.81	-24.87	8.0	15.1	153.9	14.0	103
1985	11	10	.0	2446379.5	4 36.232	+22 14.20	4 38.382	+22 18.56	.84	-39.76	1.79	-24.93	7.9	15.0	156.4	12.8	119
1985	11	11	.0	2446380.5	4 29.369	+22 13.56	4 31.516	+22 18.25	.82	-38.33	1.78	-24.99	7.8	14.9	158.9	11.5	135
1985	11	12	.0	2446381.5	4 22.098	+22 11.63	4 24.241	+22 16.67	.80	-36.79	1.76	-25.04	7.7	14.8	161.6	10.2	152
1985	11	13	.0	2446382.5	4 14.410	+22 8.21	4 16.547	+22 13.62	.78	-35.13	1.75	-25.10	7.6	14.8	164.4	8.8	169
1985	11	14	.0	2446383.5	4 6.295	+22 3.08	4 8.426	+22 8.86	.76	-33.36	1.73	-25.16	7.5	14.7	167.2	7.3	173
1985	11	15	.0	2446384.5	3 57.750	+21 55.99	3 59.875	+22 2.16	.74	-31.47	1.72	-25.21	7.4	14.6	170.1	5.7	156
1985	11	16	.0	2446385.5	3 48.778	+21 46.68	3 50.895	+21 53.26	.72	-29.45	1.71	-25.27	7.3	14.5	173.1	4.0	139
1985	11	17	.0	2446386.5	3 39.387	+21 34.93	3 41.493	+21 41.91	.70	-27.30	1.69	-25.33	7.2	14.5	176.0	2.4	123
1985	11	18	.0	2446387.5	3 29.590	+21 20.46	3 31.686	+21 27.86	.69	-25.03	1.68	-25.38	7.1	14.4	177.7	1.4	107
1985	11	19	.0	2446388.5	3 19.411	+21 3.08	3 21.495	+21 10.89	.67	-22.64	1.66	-25.44	7.1	14.3	175.9	2.4	92
1985	11	20	.0	2446389.5	3 8.881	+20 42.57	3 10.952	+20 50.80	.66	-20.13	1.65	-25.50	7.0	14.3	172.8	4.3	76
1985	11	21	.0	2446390.5	2 58.040	+20 18.80	3 .096	+20 27.44	.65	-17.52	1.63	-25.55	6.9	14.2	169.3	6.4	61
1985	11	22	.0	2446391.5	2 46.935	+19 51.67	2 48.975	+20 .71	.64	-14.81	1.62	-25.61	6.8	14.2	165.7	8.7	47
1985	11	23	.0	2446392.5	2 35.621	+19 21.16	2 37.645	+19 30.59	.63	-12.03	1.60	-25.67	6.8	14.1	162.0	11.0	32
1985	11	24	.0	2446393.5	2 24.161	+18 47.34	2 26.168	+18 57.13	.63	-9.19	1.59	-25.72	6.7	14.1	158.3	13.3	18
1985	11	25	.0	2446394.5	2 12.619	+18 10.35	2 14.609	+18 20.48	.62	-6.31	1.57	-25.78	6.6	14.1	154.5	15.7	5
1985	11	26	.0	2446395.5	2 1.065	+17 30.42	2 3.037	+17 40.86	.62	-3.43	1.56	-25.83	6.6	14.0	150.7	18.1	12
1985	11	27	.0	2446396.5	1 49.566	+16 47.86	1 51.522	+16 58.58	.62	-.55	1.54	-25.89	6.5	14.0	146.9	20.5	26
1985	11	28	.0	2446397.5	1 38.189	+16 3.02	1 40.129	+16 14.01	.62	2.29	1.53	-25.94	6.5	14.0	143.0	22.8	41
1985	11	29	.0	2446398.5	1 26.996	+15 16.35	1 28.920	+15 27.56	.62	5.07	1.51	-25.99	6.4	14.0	139.2	25.2	55
1985	11	30	.0	2446399.5	1 16.043	+14 28.29	1 17.953	+14 39.69	.63	7.77	1.50	-26.05	6.4	14.0	135.5	27.5	70
1985	12	1	.0	2446400.5	1 5.379	+13 39.29	1 7.275	+13 50.87	.63	10.37	1.48	-26.10	6.4	14.0	131.7	29.7	85
1985	12	2	.0	2446401.5	0 55.043	+12 49.83	0 56.926	+13 1.54	.64	12.85	1.47	-26.15	6.3	14.0	128.1	31.9	100
1985	12	3	.0	2446402.5	0 45.067	+12 .33	0 46.940	+12 12.14	.65	15.20	1.45	-26.20	6.3	14.0	124.5	34.0	115
1985	12	4	.0	2446403.5	0 35.476	+11 11.18	0 37.339	+11 23.07	.66	17.40	1.44	-26.25	6.3	14.0	121.0	36.0	130
1985	12	5	.0	2446404.5	0 26.284	+10 22.72	0 28.138	+10 34.68	.67	19.47	1.42	-26.30	6.3	14.0	117.6	37.9	145
1985	12	6	.0	2446405.5	0 17.500	+ 9 35.26	0 19.347	+ 9 47.25	.68	21.38	1.41	-26.34	6.3	14.0	114.3	39.7	159
1985	12	7	.0	2446406.5	0 9.127	+ 8 49.03	0 10.967	+ 9 1.04	.69	23.14	1.39	-26.39	6.3	14.0	111.1	41.3	169
1985	12	8	.0	2446407.5	0 1.161	+ 8 4.22	0 2.996	+ 8 16.23	.70	24.75	1.38	-26.43	6.2	14.0	108.0	42.9	162
1985	12	9	.0	2446408.5	23 53.595	+ 7 20.97	23 55.425	+ 7 32.97	.72	26.22	1.36	-26.48	6.2	14.1	105.0	44.3	147
1985	12	10	.0	2446409.5	23 46.417	+ 6 39.38	23 48.244	+ 6 51.36	.73	27.55	1.35	-26.52	6.2	14.1	102.1	45.7	131
1985	12	11	.0	2446410.5	23 39.614	+ 5 59.50	23 41.439	+ 6 11.45	.75	28.75	1.33	-26.56	6.2	14.1	99.2	46.9	114
1985	12	12	.0	2446411.5	23 33.172	+ 5 21.37	23 34.994	+ 5 33.27	.77	29.81	1.32	-26.59	6.2	14.1	96.5	48.1	97
1985	12	13	.0	2446412.5	23 27.072	+ 4 44.97	23 28.893	+ 4 56.83	.79	30.76	1.30	-26.63	6.2	14.1	93.9	49.1	81
1985	12	14	.0	2446413.5	23 21.298	+ 4 10.29	23 23.118	+ 4 22.09	.80	31.59	1.28	-26.66	6.2	14.2	91.3	50.0	65
1985	12	15	.0	2446414.5	23 15.832	+ 3 37.27	23 17.652	+ 3 49.02	.82	32.31	1.27	-26.69	6.2	14.2	88.8	50.8	50
1985	12	16	.0	2446415.5	23 10.656	+ 3 5.88	23 12.475	+ 3 17.57	.84	32.94	1.25	-26.72	6.2	14.2	86.4	51.6	35
1985	12	17	.0	2446416.5	23 5.752	+ 2 36.04	23 7.572	+ 2 47.67	.86	33.47	1.24	-26.74	6.2	14.2	84.1	52.2	22
1985	12	18	.0	2446417.5	23 1.104	+ 2 7.69	23 2.924	+ 2 19.25	.88	33.92	1.22	-26.76	6.2	14.3	81.8	52.8	12
1985	12	19	.0	2446418.5	22 56.695	+ 1 40.75	22 58.515	+ 1 52.25	.90	34.29	1.21	-26.78	6.1	14.3	79.6	53.3	14
1985	12	20	.0	2446419.5	22 52.509	+ 1 15.15	22 54.330	+ 1 26.58	.92	34.58	1.19	-26.79	6.1	14.3	77.5	53.7	24

YR	MN	DY	HR	J.D.	R.A. (1950)	DEC.	R.A. APPN	DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1985	12	21	.0	2446420.5	22 48.532	+ 0 50.82	22 50.353	+ 1 2.18	.94	34.80	1.18	-26.80	6.1	14.3	75.4	54.0	36
1985	12	22	.0	2446421.5	22 44.748	+ 0 27.67	22 46.571	+ 0 38.96	.96	34.96	1.16	-26.81	6.1	14.3	73.4	54.3	48
1985	12	23	.0	2446422.5	22 41.145	+ 0 5.63	22 42.969	+ 0 16.86	.98	35.06	1.15	-26.81	6.1	14.3	71.4	54.5	61
1985	12	24	.0	2446423.5	22 37.710	- 0 15.36	22 39.535	- 0 4.20	1.00	35.10	1.13	-26.80	6.1	14.4	69.5	54.6	73
1985	12	25	.0	2446424.5	22 34.431	- 0 35.37	22 36.257	- 0 24.28	1.02	35.09	1.11	-26.79	6.0	14.4	67.6	54.7	86
1985	12	26	.0	2446425.5	22 31.296	- 0 54.48	22 33.124	- 0 43.45	1.04	35.02	1.10	-26.77	6.0	14.4	65.7	54.7	98
1985	12	27	.0	2446426.5	22 28.296	- 1 12.74	22 30.125	- 1 1.77	1.06	34.91	1.08	-26.74	6.0	14.4	63.9	54.6	111
1985	12	28	.0	2446427.5	22 25.420	- 1 30.22	22 27.251	- 1 19.31	1.08	34.76	1.07	-26.71	6.0	14.4	62.1	54.5	124
1985	12	29	.0	2446428.5	22 22.660	- 1 46.96	22 24.492	- 1 36.12	1.10	34.56	1.05	-26.67	5.9	14.4	60.4	54.3	136
1985	12	30	.0	2446429.5	22 20.006	- 2 3.03	22 21.839	- 1 52.25	1.12	34.31	1.04	-26.62	5.9	14.4	58.7	54.1	149
1985	12	31	.0	2446430.5	22 17.450	- 2 18.48	22 19.285	- 2 7.75	1.14	34.03	1.02	-26.56	5.9	14.4	57.0	53.8	160
1986	1	1	.0	2446431.5	22 14.985	- 2 33.34	22 16.822	- 2 22.68	1.16	33.71	1.01	-26.49	5.8	14.4	55.3	53.4	167
1986	1	2	.0	2446432.5	22 12.603	- 2 47.69	22 14.442	- 2 37.08	1.18	33.35	.99	-26.41	5.8	14.4	53.7	53.0	162
1986	1	3	.0	2446433.5	22 10.299	- 3 1.54	22 12.138	- 2 50.99	1.20	32.96	.98	-26.32	5.7	14.4	52.0	52.6	150
1986	1	4	.0	2446434.5	22 8.064	- 3 14.95	22 9.905	- 3 4.46	1.22	32.52	.96	-26.22	5.7	14.4	50.4	52.1	137
1986	1	5	.0	2446435.5	22 5.894	- 3 27.96	22 7.737	- 3 17.52	1.24	32.05	.95	-26.10	5.7	14.4	48.9	51.5	123
1986	1	6	.0	2446436.5	22 3.783	- 3 40.60	22 5.627	- 3 30.22	1.25	31.55	.93	-25.96	5.6	14.4	47.3	50.9	108
1986	1	7	.0	2446437.5	22 1.726	- 3 52.90	22 3.571	- 3 42.58	1.27	31.01	.92	-25.81	5.6	14.4	45.7	50.3	94
1986	1	8	.0	2446438.5	21 59.716	- 4 4.92	22 1.564	- 3 54.65	1.29	30.43	.90	-25.64	5.5	14.4	44.2	49.5	79
1986	1	9	.0	2446439.5	21 57.750	- 4 16.66	21 59.599	- 4 6.45	1.31	29.81	.89	-25.46	5.5	14.4	42.7	48.8	64
1986	1	10	.0	2446440.5	21 55.823	- 4 28.18	21 57.674	- 4 18.02	1.32	29.16	.87	-25.25	5.4	14.4	41.2	48.0	49
1986	1	11	.0	2446441.5	21 53.930	- 4 39.50	21 55.783	- 4 29.39	1.34	28.47	.86	-25.02	5.4	14.4	39.7	47.1	35
1986	1	12	.0	2446442.5	21 52.068	- 4 50.64	21 53.923	- 4 40.58	1.36	27.75	.84	-24.76	5.3	14.4	38.2	46.2	22
1986	1	13	.0	2446443.5	21 50.232	- 5 1.64	21 52.088	- 4 51.64	1.37	26.99	.83	-24.48	5.3	14.4	36.7	45.2	12
1986	1	14	.0	2446444.5	21 48.419	- 5 12.53	21 50.277	- 5 2.58	1.39	26.19	.81	-24.17	5.2	14.4	35.2	44.1	15
1986	1	15	.0	2446445.5	21 46.624	- 5 23.34	21 48.484	- 5 13.44	1.40	25.35	.80	-23.83	5.1	14.4	33.7	43.0	25
1986	1	16	.0	2446446.5	21 44.846	- 5 34.08	21 46.707	- 5 24.23	1.42	24.48	.79	-23.46	5.1	14.3	32.3	41.9	37
1986	1	17	.0	2446447.5	21 43.080	- 5 44.78	21 44.943	- 5 34.99	1.43	23.56	.77	-23.06	5.0	14.3	30.8	40.7	50
1986	1	18	.0	2446448.5	21 41.323	- 5 55.47	21 43.188	- 5 45.74	1.44	22.60	.76	-22.62	4.9	14.3	29.4	39.4	62
1986	1	19	.0	2446449.5	21 39.574	- 6 6.18	21 41.440	- 5 56.50	1.46	21.60	.75	-22.14	4.9	14.3	27.9	38.1	74
1986	1	20	.0	2446450.5	21 37.828	- 6 16.92	21 39.697	- 6 7.29	1.47	20.56	.73	-21.62	4.8	14.3	26.5	36.7	86
1986	1	21	.0	2446451.5	21 36.085	- 6 27.72	21 37.956	- 6 18.14	1.48	19.47	.72	-21.05	4.8	14.2	25.1	35.3	98
1986	1	22	.0	2446452.5	21 34.342	- 6 38.59	21 36.214	- 6 29.07	1.49	18.34	.71	-20.44	4.7	14.2	23.6	33.8	110
1986	1	23	.0	2446453.5	21 32.596	- 6 49.57	21 34.471	- 6 40.10	1.50	17.17	.70	-19.78	4.6	14.2	22.2	32.2	122
1986	1	24	.0	2446454.5	21 30.847	- 7 .66	21 32.724	- 6 51.25	1.51	15.94	.69	-19.07	4.6	14.2	20.8	30.6	134
1986	1	25	.0	2446455.5	21 29.092	- 7 11.89	21 30.972	- 7 2.54	1.52	14.67	.68	-18.31	4.5	14.2	19.4	28.9	147
1986	1	26	.0	2446456.5	21 27.331	- 7 23.27	21 29.213	- 7 13.98	1.53	13.35	.67	-17.49	4.4	14.1	18.0	27.2	158
1986	1	27	.0	2446457.5	21 25.562	- 7 34.83	21 27.446	- 7 25.59	1.54	11.99	.66	-16.61	4.4	14.1	16.7	25.5	167
1986	1	28	.0	2446458.5	21 23.784	- 7 46.57	21 25.671	- 7 37.40	1.54	10.57	.65	-15.68	4.3	14.1	15.3	23.7	164
1986	1	29	.0	2446459.5	21 21.998	- 7 58.51	21 23.887	- 7 49.40	1.55	9.11	.64	-14.70	4.3	14.1	14.0	21.9	153
1986	1	30	.0	2446460.5	21 20.203	- 8 10.67	21 22.094	- 8 1.62	1.55	7.61	.63	-13.65	4.2	14.1	12.7	20.0	140
1986	1	31	.0	2446461.5	21 18.398	- 8 23.05	21 20.292	- 8 14.06	1.56	6.06	.62	-12.55	4.1	14.0	11.4	18.2	127
1986	2	1	.0	2446462.5	21 16.585	- 8 35.66	21 18.482	- 8 26.74	1.56	4.47	.62	-11.39	4.1	14.0	10.2	16.5	113
1986	2	2	.0	2446463.5	21 14.763	- 8 48.52	21 16.663	- 8 39.66	1.56	2.84	.61	-10.18	4.1	14.0	9.1	14.8	99
1986	2	3	.0	2446464.5	21 12.934	- 9 1.64	21 14.837	- 8 52.83	1.56	1.18	.60	-8.93	4.0	14.0	8.1	13.3	84
1986	2	4	.0	2446465.5	21 11.099	- 9 15.00	21 13.004	- 9 6.27	1.56	-.52	.60	-7.62	4.0	14.0	7.3	12.1	70
1986	2	5	.0	2446466.5	21 9.258	- 9 28.63	21 11.167	- 9 19.96	1.56	-2.24	.60	-6.28	3.9	13.9	6.8	11.2	55
1986	2	6	.0	2446467.5	21 7.413	- 9 42.52	21 9.326	- 9 33.92	1.56	-3.98	.59	-4.91	3.9	13.9	6.5	10.9	41
1986	2	7	.0	2446468.5	21 5.566	- 9 56.68	21 7.482	- 9 48.14	1.56	-5.73	.59	-3.50	3.9	13.9	6.6	11.1	27
1986	2	8	.0	2446469.5	21 3.718	-10 11.11	21 5.638	-10 2.63	1.55	-7.48	.59	-2.08	3.9	13.9	7.0	11.8	15

YR	MN	DY	HR	J.D.	R.A. (1950)		DEC.		R.A. APPN		DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1986	2	9	.0	2446470.5	21	1.872	-10	25.80	21	3.794	-10 17.39	1.55	-9.24	.59	-.65	4.1	13.9	7.7	13.1	11
1986	2	10	.0	2446471.5	21	.028	-10	40.75	21	1.954	-10 32.42	1.54	-10.99	.59	.79	4.1	13.9	8.6	14.6	20
1986	2	11	.0	2446472.5	20	58.188	-10	55.97	21	.118	-10 47.71	1.54	-12.72	.59	2.22	4.1	13.9	9.7	16.4	32
1986	2	12	.0	2446473.5	20	56.354	-11	11.46	20	58.288	-11 3.26	1.53	-14.43	.59	3.64	4.1	13.9	10.9	18.4	45
1986	2	13	.0	2446474.5	20	54.528	-11	27.20	20	56.466	-11 19.07	1.52	-16.12	.59	5.04	4.1	13.9	12.1	20.5	58
1986	2	14	.0	2446475.5	20	52.711	-11	43.21	20	54.652	-11 35.15	1.51	-17.77	.60	6.41	4.1	13.9	13.4	22.6	70
1986	2	15	.0	2446476.5	20	50.904	-11	59.47	20	52.849	-11 51.48	1.50	-19.38	.60	7.75	4.1	13.9	14.7	24.8	83
1986	2	16	.0	2446477.5	20	49.107	-12	16.00	20	51.056	-12 8.08	1.49	-20.95	.60	9.05	4.1	13.9	16.1	26.9	95
1986	2	17	.0	2446478.5	20	47.322	-12	32.80	20	49.275	-12 24.94	1.48	-22.46	.61	10.30	4.1	13.9	17.5	29.1	107
1986	2	18	.0	2446479.5	20	45.548	-12	49.86	20	47.506	-12 42.08	1.46	-23.93	.62	11.51	4.2	13.9	18.9	31.2	119
1986	2	19	.0	2446480.5	20	43.786	-13	7.21	20	45.748	-12 59.49	1.45	-25.35	.62	12.66	4.2	13.9	20.3	33.3	132
1986	2	20	.0	2446481.5	20	42.035	-13	24.83	20	44.002	-13 17.18	1.43	-26.70	.63	13.75	4.2	13.9	21.7	35.4	144
1986	2	21	.0	2446482.5	20	40.294	-13	42.76	20	42.266	-13 35.17	1.42	-28.01	.64	14.79	4.2	13.9	23.1	37.4	156
1986	2	22	.0	2446483.5	20	38.562	-14	.99	20	40.539	-13 53.48	1.40	-29.25	.65	15.78	4.2	13.9	24.6	39.4	167
1986	2	23	.0	2446484.5	20	36.838	-14	19.55	20	38.819	-14 12.10	1.38	-30.44	.66	16.70	4.2	13.9	26.0	41.3	169
1986	2	24	.0	2446485.5	20	35.119	-14	38.46	20	37.106	-14 31.08	1.37	-31.57	.67	17.57	4.3	13.9	27.4	43.1	159
1986	2	25	.0	2446486.5	20	33.404	-14	57.73	20	35.396	-14 50.42	1.35	-32.65	.68	18.38	4.3	13.9	28.9	44.9	146
1986	2	26	.0	2446487.5	20	31.690	-15	17.40	20	33.687	-15 10.16	1.33	-33.67	.69	19.14	4.3	13.9	30.3	46.6	132
1986	2	27	.0	2446488.5	20	29.974	-15	37.49	20	31.976	-15 30.32	1.31	-34.64	.70	19.85	4.3	13.9	31.8	48.2	118
1986	2	28	.0	2446489.5	20	28.252	-15	58.03	20	30.259	-15 50.93	1.29	-35.56	.71	20.50	4.4	13.9	33.3	49.8	103
1986	3	1	.0	2446490.5	20	26.520	-16	19.06	20	28.534	-16 12.03	1.27	-36.42	.72	21.11	4.4	13.9	34.7	51.3	88
1986	3	2	.0	2446491.5	20	24.775	-16	40.63	20	26.794	-16 33.67	1.25	-37.24	.74	21.67	4.4	13.9	36.2	52.7	74
1986	3	3	.0	2446492.5	20	23.012	-17	2.76	20	25.037	-16 55.87	1.22	-38.01	.75	22.19	4.4	13.9	37.7	54.1	59
1986	3	4	.0	2446493.5	20	21.225	-17	25.52	20	23.257	-17 18.70	1.20	-38.73	.76	22.66	4.4	13.9	39.2	55.3	45
1986	3	5	.0	2446494.5	20	19.408	-17	48.95	20	21.447	-17 42.21	1.18	-39.40	.77	23.10	4.4	13.9	40.7	56.6	31
1986	3	6	.0	2446495.5	20	17.556	-18	13.12	20	19.602	-18 6.45	1.16	-40.03	.79	23.50	4.5	13.9	42.2	57.7	17
1986	3	7	.0	2446496.5	20	15.662	-18	38.08	20	17.714	-18 31.49	1.13	-40.62	.80	23.87	4.5	13.9	43.7	58.8	6
1986	3	8	.0	2446497.5	20	13.717	-19	3.90	20	15.777	-18 57.40	1.11	-41.16	.82	24.20	4.5	13.9	45.3	59.8	13
1986	3	9	.0	2446498.5	20	11.713	-19	30.66	20	13.781	-19 24.25	1.09	-41.65	.83	24.51	4.5	13.9	46.8	60.7	27
1986	3	10	.0	2446499.5	20	9.642	-19	58.45	20	11.718	-19 52.12	1.06	-42.10	.84	24.79	4.5	13.9	48.4	61.6	40
1986	3	11	.0	2446500.5	20	7.493	-20	27.34	20	9.578	-20 21.10	1.04	-42.51	.86	25.04	4.5	13.8	50.0	62.4	54
1986	3	12	.0	2446501.5	20	5.255	-20	57.44	20	7.348	-20 51.30	1.01	-42.87	.87	25.27	4.5	13.8	51.6	63.1	67
1986	3	13	.0	2446502.5	20	2.916	-21	28.84	20	5.018	-21 22.80	.99	-43.18	.89	25.47	4.5	13.8	53.2	63.8	80
1986	3	14	.0	2446503.5	20	.461	-22	1.67	20	2.573	-21 55.74	.96	-43.44	.90	25.66	4.5	13.8	54.9	64.3	93
1986	3	15	.0	2446504.5	19	57.875	-22	36.05	19	59.997	-22 30.23	.94	-43.65	.92	25.83	4.5	13.8	56.6	64.8	105
1986	3	16	.0	2446505.5	19	55.140	-23	12.10	19	57.274	-23 6.40	.91	-43.81	.93	25.98	4.5	13.7	58.4	65.3	118
1986	3	17	.0	2446506.5	19	52.237	-23	49.97	19	54.384	-23 44.40	.89	-43.92	.95	26.11	4.5	13.7	60.1	65.6	131
1986	3	18	.0	2446507.5	19	49.144	-24	29.81	19	51.303	-24 24.38	.86	-43.97	.96	26.23	4.5	13.7	62.0	65.9	143
1986	3	19	.0	2446508.5	19	45.836	-25	11.79	19	48.009	-25 6.50	.84	-43.95	.98	26.33	4.5	13.7	63.8	66.1	156
1986	3	20	.0	2446509.5	19	42.282	-25	56.08	19	44.470	-25 50.96	.81	-43.87	.99	26.42	4.5	13.6	65.8	66.1	169
1986	3	21	.0	2446510.5	19	38.451	-26	42.86	19	40.655	-26 37.92	.79	-43.71	1.01	26.50	4.4	13.6	67.8	66.1	176
1986	3	22	.0	2446511.5	19	34.305	-27	32.33	19	36.526	-27 27.58	.76	-43.47	1.02	26.57	4.4	13.6	69.8	66.0	163
1986	3	23	.0	2446512.5	19	29.798	-28	24.68	19	32.038	-28 20.14	.73	-43.14	1.04	26.63	4.4	13.5	71.9	65.8	149
1986	3	24	.0	2446513.5	19	24.882	-29	20.11	19	27.142	-29 15.80	.71	-42.72	1.05	26.68	4.4	13.5	74.1	65.5	134
1986	3	25	.0	2446514.5	19	19.495	-30	18.79	19	21.777	-30 14.74	.69	-42.18	1.07	26.72	4.3	13.4	76.5	65.0	119
1986	3	26	.0	2446515.5	19	13.571	-31	20.90	19	15.876	-31 17.14	.66	-41.52	1.09	26.75	4.3	13.4	78.9	64.4	103
1986	3	27	.0	2446516.5	19	7.028	-32	26.57	19	9.359	-32 23.12	.64	-40.73	1.10	26.77	4.3	13.3	81.4	63.7	87
1986	3	28	.0	2446517.5	18	59.774	-33	35.86	19	2.133	-33 32.77	.61	-39.78	1.12	26.79	4.2	13.3	84.0	62.8	71
1986	3	29	.0	2446518.5	18	51.700	-34	48.75	18	54.089	-34 46.06	.59	-38.66	1.13	26.80	4.2	13.2	86.8	61.8	55
1986	3	30	.0	2446519.5	18	42.681	-36	5.09	18	45.102	-36 2.85	.57	-37.33	1.15	26.81	4.2	13.2	89.7	60.5	39

YR	MN	DY	HR	J.D.	R.A. (1950)	DEC.	R.A. APPN	DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1986	3	31	.0	2446520.5	18 32.573	-37 24.52	18 35.029	-37 22.80	.55	-35.79	1.16	26.81	4.1	13.1	92.7	59.1	23
1986	4	1	.0	2446521.5	18 21.216	-38 46.42	18 23.709	-38 45.29	.53	-34.01	1.18	26.80	4.1	13.1	96.0	57.5	11
1986	4	2	.0	2446522.5	18 8.434	-40 9.82	18 10.964	-40 9.35	.51	-31.95	1.19	26.79	4.1	13.0	99.4	55.7	16
1986	4	3	.0	2446523.5	17 54.041	-41 33.29	17 56.608	-41 33.57	.49	-29.59	1.21	26.78	4.0	13.0	102.9	53.7	30
1986	4	4	.0	2446524.5	17 37.859	-42 54.83	17 40.460	-42 55.96	.48	-26.92	1.22	26.76	4.0	12.9	106.7	51.5	46
1986	4	5	.0	2446525.5	17 19.738	-44 11.82	17 22.367	-44 13.89	.46	-23.90	1.24	26.74	4.0	12.9	110.6	49.1	61
1986	4	6	.0	2446526.5	16 59.592	-45 21.01	17 2.240	-45 24.11	.45	-20.55	1.26	26.72	4.0	12.8	114.7	46.4	77
1986	4	7	.0	2446527.5	16 37.445	-46 18.61	16 40.098	-46 22.83	.44	-16.87	1.27	26.69	3.9	12.8	118.8	43.6	93
1986	4	8	.0	2446528.5	16 13.480	-47 .62	16 16.119	-47 6.01	.43	-12.87	1.29	26.66	3.9	12.8	123.1	40.7	108
1986	4	9	.0	2446529.5	15 48.072	-47 23.32	15 50.676	-47 29.88	.42	-8.61	1.30	26.63	3.9	12.8	127.3	37.7	123
1986	4	10	.0	2446530.5	15 21.785	-47 23.82	15 24.332	-47 31.52	.42	-4.14	1.32	26.59	4.0	12.8	131.5	34.8	137
1986	4	11	.0	2446531.5	14 55.313	-47 .73	14 57.785	-47 9.47	.42	.45	1.33	26.55	4.0	12.8	135.5	31.8	147
1986	4	12	.0	2446532.5	14 28.382	-46 14.43	14 31.767	-46 24.08	.42	5.08	1.35	26.51	4.0	12.9	139.2	28.1	152
1986	4	13	.0	2446533.5	14 4.639	-45 7.06	14 6.931	-45 17.48	.42	9.65	1.36	26.47	4.1	12.9	142.4	26.7	148
1986	4	14	.0	2446534.5	13 41.560	-43 42.13	13 43.765	-43 53.15	.43	14.08	1.38	26.43	4.2	13.0	145.2	24.6	137
1986	4	15	.0	2446535.5	13 20.433	-42 3.87	13 22.556	-42 15.33	.44	18.31	1.39	26.38	4.3	13.0	147.3	22.9	125
1986	4	16	.0	2446536.5	13 1.359	-40 16.62	13 3.412	-40 28.40	.45	22.27	1.41	26.34	4.4	13.1	148.7	21.7	111
1986	4	17	.0	2446537.5	12 44.308	-38 24.38	12 46.302	-38 36.38	.47	25.94	1.42	26.29	4.5	13.2	149.3	21.1	97
1986	4	18	.0	2446538.5	12 29.158	-36 30.52	12 31.105	-36 42.66	.48	29.29	1.44	26.24	4.6	13.3	149.3	20.9	83
1986	4	19	.0	2446539.5	12 15.744	-34 37.68	12 17.651	-34 49.90	.50	32.34	1.45	26.19	4.7	13.4	148.7	21.0	69
1986	4	20	.0	2446540.5	12 3.880	-32 47.80	12 5.757	-33 .05	.52	35.07	1.47	26.14	4.8	13.5	147.7	21.4	56
1986	4	21	.0	2446541.5	11 53.386	-31 2.20	11 55.239	-31 14.45	.54	37.53	1.48	26.09	4.9	13.6	146.4	22.0	43
1986	4	22	.0	2446542.5	11 44.091	-29 21.71	11 45.926	-29 33.93	.56	39.71	1.50	26.04	5.0	13.7	144.8	22.8	33
1986	4	23	.0	2446543.5	11 35.843	-27 46.77	11 37.664	-27 58.95	.59	41.66	1.51	25.99	5.2	13.8	143.0	23.5	29
1986	4	24	.0	2446544.5	11 28.508	-26 17.53	11 30.318	-26 29.67	.61	43.39	1.53	25.93	5.3	13.9	141.2	24.3	34
1986	4	25	.0	2446545.5	11 21.967	-24 53.98	11 23.770	-25 6.06	.64	44.94	1.54	25.88	5.4	14.1	139.3	25.1	44
1986	4	26	.0	2446546.5	11 16.121	-23 35.94	11 17.918	-23 47.97	.66	46.31	1.56	25.83	5.5	14.2	137.5	25.9	57
1986	4	27	.0	2446547.5	11 10.883	-22 23.17	11 12.676	-22 35.14	.69	47.52	1.57	25.77	5.6	14.3	135.6	26.6	72
1986	4	28	.0	2446548.5	11 6.178	-21 15.39	11 7.968	-21 27.30	.72	48.61	1.59	25.72	5.8	14.4	133.8	27.2	86
1986	4	29	.0	2446549.5	11 1.943	-20 12.27	11 3.731	-20 24.13	.74	49.58	1.60	25.66	5.9	14.5	132.0	27.8	100
1986	4	30	.0	2446550.5	10 58.123	-19 13.50	10 59.910	-19 25.30	.77	50.45	1.62	25.61	6.0	14.6	130.2	28.4	114
1986	5	1	.0	2446551.5	10 54.671	-18 18.77	10 56.457	-18 30.52	.80	51.22	1.63	25.55	6.1	14.7	128.5	28.9	127
1986	5	2	.0	2446552.5	10 51.546	-17 27.78	10 53.333	-17 39.48	.83	51.92	1.65	25.49	6.2	14.8	126.9	29.3	139
1986	5	3	.0	2446553.5	10 48.715	-16 40.24	10 50.502	-16 51.89	.86	52.54	1.66	25.44	6.3	14.9	125.2	29.7	148
1986	5	4	.0	2446554.5	10 46.145	-15 55.89	10 47.933	-16 7.49	.89	53.10	1.68	25.38	6.4	15.0	123.7	30.0	154
1986	5	5	.0	2446555.5	10 43.812	-15 14.48	10 45.600	-15 26.04	.92	53.60	1.69	25.32	6.5	15.1	122.1	30.3	153
1986	5	6	.0	2446556.5	10 41.691	-14 35.79	10 43.480	-14 47.31	.96	54.05	1.71	25.27	6.6	15.2	120.6	30.6	147
1986	5	7	.0	2446557.5	10 39.762	-13 59.61	10 41.552	-14 11.09	.99	54.45	1.72	25.21	6.7	15.3	119.2	30.8	138
1986	5	8	.0	2446558.5	10 38.008	-13 25.74	10 39.799	-13 37.19	1.02	54.81	1.74	25.15	6.8	15.3	117.8	31.0	127
1986	5	9	.0	2446559.5	10 36.413	-12 54.03	10 38.205	-13 5.44	1.05	55.13	1.75	25.10	6.9	15.4	116.4	31.1	116
1986	5	10	.0	2446560.5	10 34.962	-12 24.29	10 36.756	-12 35.67	1.08	55.41	1.76	25.04	7.0	15.5	115.0	31.2	105
1986	5	11	.0	2446561.5	10 33.644	-11 56.39	10 35.439	-12 7.75	1.11	55.66	1.78	24.98	7.1	15.6	113.7	31.3	94
1986	5	12	.0	2446562.5	10 32.447	-11 30.20	10 34.243	-11 41.53	1.15	55.89	1.79	24.92	7.2	15.7	112.4	31.4	82
1986	5	13	.0	2446563.5	10 31.361	-11 5.60	10 33.159	-11 16.90	1.18	56.09	1.81	24.87	7.3	15.7	111.1	31.4	71
1986	5	14	.0	2446564.5	10 30.378	-10 42.46	10 32.177	-10 53.75	1.21	56.26	1.82	24.81	7.4	15.8	109.9	31.4	60
1986	5	15	.0	2446565.5	10 29.490	-10 20.70	10 31.290	-10 31.97	1.24	56.41	1.84	24.76	7.4	15.9	108.7	31.4	49
1986	5	16	.0	2446566.5	10 28.688	-10 .22	10 30.490	-10 11.46	1.28	56.54	1.85	24.70	7.5	16.0	107.5	31.4	38
1986	5	17	.0	2446567.5	10 27.968	- 9 40.93	10 29.771	- 9 52.15	1.31	56.65	1.87	24.64	7.6	16.0	106.3	31.4	28
1986	5	18	.0	2446568.5	10 27.323	- 9 22.75	10 29.127	- 9 33.96	1.34	56.74	1.88	24.59	7.7	16.1	105.1	31.3	22
1986	5	19	.0	2446569.5	10 26.748	- 9 5.62	10 28.553	- 9 16.81	1.37	56.81	1.89	24.53	7.8	16.2	104.0	31.2	22

YR	MN	DY	HR	J.D.	R.A. (1950)	DEC.	R.A. APPN	DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1986	5	20	.0	2446570.5	10 26.237	- 8 49.46	10 28.043	- 9 .64	1.41	56.87	1.91	24.48	7.8	16.2	102.9	31.1	29
1986	5	21	.0	2446571.5	10 25.787	- 8 34.22	10 27.594	- 8 45.39	1.44	56.91	1.92	24.42	7.9	16.3	101.8	31.0	40
1986	5	22	.0	2446572.5	10 25.393	- 8 19.84	10 27.201	- 8 31.00	1.47	56.94	1.94	24.36	8.0	16.4	100.7	30.9	53
1986	5	23	.0	2446573.5	10 25.053	- 8 6.26	10 26.861	- 8 17.41	1.51	56.95	1.95	24.31	8.1	16.4	99.6	30.8	67
1986	5	24	.0	2446574.5	10 24.761	- 7 53.45	10 26.571	- 8 4.59	1.54	56.96	1.96	24.25	8.1	16.5	98.6	30.7	81
1986	5	25	.0	2446575.5	10 24.516	- 7 41.35	10 26.327	- 7 52.49	1.57	56.95	1.98	24.20	8.2	16.6	97.5	30.5	96
1986	5	26	.0	2446576.5	10 24.314	- 7 29.93	10 26.126	- 7 41.06	1.60	56.93	1.99	24.15	8.3	16.6	96.5	30.3	110
1986	5	27	.0	2446577.5	10 24.154	- 7 19.15	10 25.966	- 7 30.27	1.64	56.90	2.01	24.09	8.3	16.7	95.5	30.2	124
1986	5	28	.0	2446578.5	10 24.032	- 7 8.97	10 25.845	- 7 20.09	1.67	56.87	2.02	24.04	8.4	16.7	94.5	30.0	137
1986	5	29	.0	2446579.5	10 23.946	- 6 59.36	10 25.760	- 7 10.48	1.70	56.82	2.03	23.98	8.5	16.8	93.5	29.8	149
1986	5	30	.0	2446580.5	10 23.895	- 6 50.29	10 25.710	- 7 1.41	1.74	56.76	2.05	23.93	8.5	16.9	92.5	29.6	157
1986	5	31	.0	2446581.5	10 23.876	- 6 41.74	10 25.692	- 6 52.85	1.77	56.69	2.06	23.88	8.6	16.9	91.5	29.5	160
1986	6	1	.0	2446582.5	10 23.889	- 6 33.68	10 25.705	- 6 44.79	1.80	56.62	2.08	23.82	8.7	17.0	90.5	29.3	155
1986	6	2	.0	2446583.5	10 23.930	- 6 26.08	10 25.747	- 6 37.19	1.83	56.53	2.09	23.77	8.7	17.0	89.6	29.0	146
1986	6	3	.0	2446584.5	10 24.000	- 6 18.93	10 25.817	- 6 30.04	1.87	56.44	2.10	23.72	8.8	17.1	88.6	28.8	136
1986	6	4	.0	2446585.5	10 24.096	- 6 12.20	10 25.913	- 6 23.31	1.90	56.34	2.12	23.67	8.8	17.1	87.7	28.6	125
1986	6	5	.0	2446586.5	10 24.216	- 6 5.87	10 26.034	- 6 16.98	1.93	56.22	2.13	23.62	8.9	17.2	86.7	28.4	114
1986	6	6	.0	2446587.5	10 24.361	- 5 59.93	10 26.179	- 6 11.04	1.96	56.11	2.14	23.56	8.9	17.2	85.8	28.2	103
1986	6	7	.0	2446588.5	10 24.528	- 5 54.35	10 26.347	- 6 5.46	2.00	55.98	2.16	23.51	9.0	17.3	84.9	27.9	92
1986	6	8	.0	2446589.5	10 24.717	- 5 49.12	10 26.536	- 6 .24	2.03	55.84	2.17	23.46	9.1	17.3	83.9	27.7	81
1986	6	9	.0	2446590.5	10 24.926	- 5 44.24	10 26.746	- 5 55.36	2.06	55.70	2.18	23.41	9.1	17.4	83.0	27.5	69
1986	6	10	.0	2446591.5	10 25.154	- 5 39.67	10 26.975	- 5 50.79	2.09	55.55	2.20	23.36	9.2	17.4	82.1	27.2	58
1986	6	11	.0	2446592.5	10 25.401	- 5 35.41	10 27.222	- 5 46.54	2.13	55.39	2.21	23.31	9.2	17.5	81.2	27.0	47
1986	6	12	.0	2446593.5	10 25.666	- 5 31.45	10 27.487	- 5 42.58	2.16	55.23	2.22	23.26	9.3	17.5	80.3	26.7	36
1986	6	13	.0	2446594.5	10 25.947	- 5 27.77	10 27.769	- 5 38.91	2.19	55.06	2.24	23.21	9.3	17.6	79.4	26.5	26
1986	6	14	.0	2446595.5	10 26.245	- 5 24.36	10 28.066	- 5 35.50	2.22	54.88	2.25	23.16	9.4	17.6	78.6	26.2	19
1986	6	15	.0	2446596.5	10 26.557	- 5 21.22	10 28.379	- 5 32.36	2.25	54.69	2.26	23.11	9.4	17.6	77.7	26.0	18
1986	6	16	.0	2446597.5	10 26.884	- 5 18.32	10 28.706	- 5 29.47	2.28	54.50	2.28	23.06	9.5	17.7	76.8	25.7	25
1986	6	17	.0	2446598.5	10 27.225	- 5 15.67	10 29.047	- 5 26.82	2.32	54.31	2.29	23.02	9.5	17.7	76.0	25.5	35
1986	6	18	.0	2446599.5	10 27.579	- 5 13.24	10 29.401	- 5 24.40	2.35	54.10	2.30	22.97	9.6	17.8	75.1	25.2	48
1986	6	19	.0	2446600.5	10 27.946	- 5 11.04	10 29.768	- 5 22.21	2.38	53.90	2.32	22.92	9.6	17.8	74.2	25.0	61
1986	6	20	.0	2446601.5	10 28.325	- 5 9.05	10 30.147	- 5 20.23	2.41	53.68	2.33	22.87	9.7	17.8	73.4	24.7	75
1986	6	21	.0	2446602.5	10 28.715	- 5 7.27	10 30.538	- 5 18.46	2.44	53.46	2.34	22.82	9.7	17.9	72.5	24.4	90
1986	6	22	.0	2446603.5	10 29.116	- 5 5.69	10 30.939	- 5 16.88	2.47	53.24	2.36	22.78	9.8	17.9	71.7	24.2	104
1986	6	23	.0	2446604.5	10 29.527	- 5 4.30	10 31.351	- 5 15.50	2.50	53.01	2.37	22.73	9.8	18.0	70.8	23.9	119
1986	6	24	.0	2446605.5	10 29.949	- 5 3.10	10 31.773	- 5 14.30	2.53	52.78	2.38	22.68	9.9	18.0	70.0	23.6	132
1986	6	25	.0	2446606.5	10 30.381	- 5 2.07	10 32.205	- 5 13.28	2.56	52.55	2.40	22.64	9.9	18.0	69.2	23.3	145
1986	6	26	.0	2446607.5	10 30.821	- 5 1.21	10 32.645	- 5 12.43	2.59	52.30	2.41	22.59	9.9	18.1	68.3	23.1	156
1986	6	27	.0	2446608.5	10 31.271	- 5 .53	10 33.095	- 5 11.76	2.62	52.06	2.42	22.55	10.0	18.1	67.5	22.8	162
1986	6	28	.0	2446609.5	10 31.729	- 5 .00	10 33.553	- 5 11.24	2.65	51.80	2.44	22.50	10.0	18.2	66.7	22.5	160
1986	6	29	.0	2446610.5	10 32.196	- 4 59.63	10 34.020	- 5 10.88	2.68	51.55	2.45	22.45	10.1	18.2	65.8	22.3	151
1986	6	30	.0	2446611.5	10 32.670	- 4 59.42	10 34.494	- 5 10.67	2.71	51.28	2.46	22.41	10.1	18.2	65.0	22.0	141
1986	7	1	.0	2446612.5	10 33.152	- 4 59.35	10 34.976	- 5 10.61	2.74	51.02	2.47	22.36	10.2	18.3	64.2	21.7	130
1986	7	2	.0	2446613.5	10 33.641	- 4 59.43	10 35.466	- 5 10.70	2.77	50.74	2.49	22.32	10.2	18.3	63.4	21.4	119
1986	7	3	.0	2446614.5	10 34.138	- 4 59.64	10 35.962	- 5 10.92	2.80	50.46	2.50	22.28	10.2	18.3	62.6	21.2	108
1986	7	4	.0	2446615.5	10 34.641	- 4 59.99	10 36.465	- 5 11.28	2.83	50.18	2.51	22.23	10.3	18.4	61.8	20.9	97
1986	7	5	.0	2446616.5	10 35.150	- 5 .48	10 36.975	- 5 11.77	2.86	49.89	2.53	22.19	10.3	18.4	61.0	20.6	85
1986	7	6	.0	2446617.5	10 35.666	- 5 1.09	10 37.491	- 5 12.39	2.89	49.60	2.54	22.14	10.4	18.4	60.2	20.3	74
1986	7	7	.0	2446618.5	10 36.188	- 5 1.82	10 38.012	- 5 13.13	2.92	49.30	2.55	22.10	10.4	18.5	59.4	20.0	63
1986	7	8	.0	2446619.5	10 36.715	- 5 2.68	10 38.539	- 5 14.00	2.94	49.00	2.56	22.06	10.4	18.5	58.6	19.8	52

YR	MN	DY	HR	J.D.	R.A. (1950)	DEC.	R.A.	APPN	DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1986	7	9	.0	2446620.5	10 37.247	- 5 3.65	10 39.072	- 5	14.98	2.97	48.69	2.58	22.02	10.5	18.5	57.8	19.5	40
1986	7	10	.0	2446621.5	10 37.785	- 5 4.73	10 39.610	- 5	16.07	3.00	48.37	2.59	21.97	10.5	18.6	57.0	19.2	30
1986	7	11	.0	2446622.5	10 38.327	- 5 5.93	10 40.152	- 5	17.27	3.03	48.06	2.60	21.93	10.5	18.6	56.2	18.9	20
1986	7	12	.0	2446623.5	10 38.874	- 5 7.23	10 40.699	- 5	18.59	3.06	47.73	2.62	21.89	10.6	18.6	55.4	18.7	15
1986	7	13	.0	2446624.5	10 39.426	- 5 8.64	10 41.250	- 5	20.00	3.08	47.41	2.63	21.85	10.6	18.6	54.6	18.4	19
1986	7	14	.0	2446625.5	10 39.981	- 5 10.15	10 41.806	- 5	21.52	3.11	47.08	2.64	21.81	10.6	18.7	53.8	18.1	29
1986	7	15	.0	2446626.5	10 40.540	- 5 11.75	10 42.365	- 5	23.13	3.14	46.74	2.65	21.77	10.7	18.7	53.0	17.8	41
1986	7	16	.0	2446627.5	10 41.104	- 5 13.46	10 42.928	- 5	24.85	3.16	46.40	2.67	21.72	10.7	18.7	52.2	17.5	54
1986	7	17	.0	2446628.5	10 41.670	- 5 15.25	10 43.495	- 5	26.65	3.19	46.06	2.68	21.68	10.7	18.8	51.4	17.3	67
1986	7	18	.0	2446629.5	10 42.240	- 5 17.14	10 44.065	- 5	28.55	3.22	45.72	2.69	21.64	10.8	18.8	50.7	17.0	81
1986	7	19	.0	2446630.5	10 42.813	- 5 19.11	10 44.638	- 5	30.53	3.24	45.37	2.70	21.60	10.8	18.8	49.9	16.7	95
1986	7	20	.0	2446631.5	10 43.389	- 5 21.17	10 45.214	- 5	32.60	3.27	45.02	2.72	21.56	10.8	18.8	49.1	16.4	109
1986	7	21	.0	2446632.5	10 43.968	- 5 23.31	10 45.793	- 5	34.75	3.30	44.67	2.73	21.52	10.9	18.9	48.3	16.2	123
1986	7	22	.0	2446633.5	10 44.550	- 5 25.53	10 46.375	- 5	36.98	3.32	44.31	2.74	21.48	10.9	18.9	47.6	15.9	137
1986	7	23	.0	2446634.5	10 45.134	- 5 27.84	10 46.959	- 5	39.29	3.35	43.95	2.75	21.44	10.9	18.9	46.8	15.6	150
1986	7	24	.0	2446635.5	10 45.720	- 5 30.22	10 47.545	- 5	41.68	3.37	43.58	2.77	21.40	11.0	18.9	46.0	15.3	160
1986	7	25	.0	2446636.5	10 46.309	- 5 32.67	10 48.134	- 5	44.15	3.40	43.22	2.78	21.37	11.0	19.0	45.3	15.1	164
1986	7	26	.0	2446637.5	10 46.900	- 5 35.20	10 48.724	- 5	46.68	3.42	42.85	2.79	21.33	11.0	19.0	44.5	14.8	158
1986	7	27	.0	2446638.5	10 47.493	- 5 37.80	10 49.317	- 5	49.29	3.45	42.47	2.80	21.29	11.1	19.0	43.7	14.5	148
1986	7	28	.0	2446639.5	10 48.088	- 5 40.47	10 49.912	- 5	51.97	3.47	42.09	2.81	21.25	11.1	19.0	43.0	14.2	137
1986	7	29	.0	2446640.5	10 48.684	- 5 43.22	10 50.509	- 5	54.72	3.50	41.71	2.83	21.21	11.1	19.1	42.2	14.0	126
1986	7	30	.0	2446641.5	10 49.282	- 5 46.03	10 51.107	- 5	57.54	3.52	41.32	2.84	21.17	11.2	19.1	41.4	13.7	115
1986	7	31	.0	2446642.5	10 49.882	- 5 48.90	10 51.707	- 6	.43	3.54	40.93	2.85	21.14	11.2	19.1	40.7	13.4	104
1986	8	1	.0	2446643.5	10 50.483	- 5 51.84	10 52.308	- 6	3.38	3.57	40.54	2.86	21.10	11.2	19.1	39.9	13.1	92
1986	8	2	.0	2446644.5	10 51.086	- 5 54.85	10 52.910	- 6	6.39	3.59	40.14	2.88	21.06	11.2	19.2	39.2	12.9	81
1986	8	3	.0	2446645.5	10 51.689	- 5 57.91	10 53.514	- 6	9.47	3.61	39.74	2.89	21.03	11.3	19.2	38.4	12.6	70
1986	8	4	.0	2446646.5	10 52.294	- 6 1.04	10 54.119	- 6	12.60	3.64	39.34	2.90	20.99	11.3	19.2	37.7	12.3	58
1986	8	5	.0	2446647.5	10 52.900	- 6 4.22	10 54.724	- 6	15.80	3.66	38.93	2.91	20.95	11.3	19.2	36.9	12.1	47
1986	8	6	.0	2446648.5	10 53.506	- 6 7.47	10 55.331	- 6	19.05	3.68	38.52	2.92	20.92	11.3	19.3	36.2	11.8	36
1986	8	7	.0	2446649.5	10 54.113	- 6 10.77	10 55.937	- 6	22.36	3.70	38.10	2.94	20.88	11.4	19.3	35.4	11.6	25
1986	8	8	.0	2446650.5	10 54.720	- 6 14.12	10 56.545	- 6	25.72	3.73	37.69	2.95	20.84	11.4	19.3	34.7	11.3	17
1986	8	9	.0	2446651.5	10 55.328	- 6 17.53	10 57.152	- 6	29.14	3.75	37.27	2.96	20.81	11.4	19.3	34.0	11.0	15
1986	8	10	.0	2446652.5	10 55.936	- 6 20.99	10 57.760	- 6	32.60	3.77	36.84	2.97	20.77	11.5	19.3	33.2	10.8	23
1986	8	11	.0	2446653.5	10 56.544	- 6 24.51	10 58.368	- 6	36.12	3.79	36.42	2.98	20.74	11.5	19.4	32.5	10.5	34
1986	8	12	.0	2446654.5	10 57.152	- 6 28.07	10 58.976	- 6	39.69	3.81	35.99	3.00	20.70	11.5	19.4	31.8	10.3	46
1986	8	13	.0	2446655.5	10 57.760	- 6 31.68	10 59.584	- 6	43.31	3.83	35.56	3.01	20.67	11.5	19.4	31.0	10.0	59
1986	8	14	.0	2446656.5	10 58.367	- 6 35.34	11 .192	- 6	46.98	3.85	35.13	3.02	20.63	11.6	19.4	30.3	9.7	73
1986	8	15	.0	2446657.5	10 58.974	- 6 39.04	11 .799	- 6	50.69	3.87	34.69	3.03	20.60	11.6	19.4	29.6	9.5	86
1986	8	16	.0	2446658.5	10 59.581	- 6 42.79	11 1.406	- 6	54.45	3.89	34.26	3.04	20.56	11.6	19.5	28.9	9.2	100
1986	8	17	.0	2446659.5	11 .187	- 6 46.58	11 2.012	- 6	58.25	3.91	33.82	3.06	20.53	11.6	19.5	28.2	9.0	114
1986	8	18	.0	2446660.5	11 .793	- 6 50.41	11 2.618	- 7	2.09	3.93	33.38	3.07	20.50	11.7	19.5	27.4	8.7	128
1986	8	19	.0	2446661.5	11 1.398	- 6 54.29	11 3.223	- 7	5.97	3.95	32.94	3.08	20.46	11.7	19.5	26.7	8.5	141
1986	8	20	.0	2446662.5	11 2.001	- 6 58.20	11 3.827	- 7	9.89	3.97	32.49	3.09	20.43	11.7	19.5	26.0	8.3	153
1986	8	21	.0	2446663.5	11 2.604	- 7 2.16	11 4.429	- 7	13.86	3.99	32.05	3.10	20.39	11.7	19.6	25.3	8.0	163
1986	8	22	.0	2446664.5	11 3.206	- 7 6.15	11 5.031	- 7	17.86	4.01	31.60	3.12	20.36	11.7	19.6	24.7	7.8	164
1986	8	23	.0	2446665.5	11 3.807	- 7 10.18	11 5.632	- 7	21.90	4.02	31.15	3.13	20.33	11.8	19.6	24.0	7.6	156
1986	8	24	.0	2446666.5	11 4.407	- 7 14.25	11 6.232	- 7	25.97	4.04	30.70	3.14	20.29	11.8	19.6	23.3	7.3	146
1986	8	25	.0	2446667.5	11 5.005	- 7 18.36	11 6.830	- 7	30.08	4.06	30.25	3.15	20.26	11.8	19.6	22.6	7.1	134
1986	8	26	.0	2446668.5	11 5.603	- 7 22.50	11 7.428	- 7	34.23	4.08	29.79	3.16	20.23	11.8	19.7	22.0	6.9	123
1986	8	27	.0	2446669.5	11 6.198	- 7 26.68	11 8.024	- 7	38.42	4.09	29.33	3.17	20.20	11.9	19.7	21.3	6.6	112

YR	MN	DY	HR	J.D.		R.A. (1950)		DEC.		R.A.	APPN	DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1986	8	28	.0	2446670.5	11	6.793	- 7	30.89	11	8.618	- 7	42.64	4.11	28.87	3.19	20.16	11.9	19.7	20.7	6.4	100
1986	8	29	.0	2446671.5	11	7.385	- 7	35.14	11	9.211	- 7	46.89	4.13	28.41	3.20	20.13	11.9	19.7	20.0	6.2	89
1986	8	30	.0	2446672.5	11	7.976	- 7	39.42	11	9.802	- 7	51.18	4.14	27.94	3.21	20.10	11.9	19.7	19.4	6.0	78
1986	8	31	.0	2446673.5	11	8.565	- 7	43.73	11	10.391	- 7	55.49	4.16	27.48	3.22	20.07	11.9	19.7	18.8	5.8	66
1986	9	1	.0	2446674.5	11	9.152	- 7	48.07	11	10.978	- 7	59.84	4.17	27.01	3.23	20.04	12.0	19.8	18.2	5.6	55
1986	9	2	.0	2446675.5	11	9.738	- 7	52.44	11	11.564	- 8	4.22	4.19	26.54	3.24	20.01	12.0	19.8	17.6	5.4	43
1986	9	3	.0	2446676.5	11	10.321	- 7	56.84	11	12.147	- 8	8.63	4.21	26.06	3.25	19.97	12.0	19.8	17.1	5.2	32
1986	9	4	.0	2446677.5	11	10.902	- 8	1.28	11	12.728	- 8	13.07	4.22	25.59	3.27	19.94	12.0	19.8	16.5	5.0	21
1986	9	5	.0	2446678.5	11	11.480	- 8	5.73	11	13.306	- 8	17.53	4.24	25.11	3.28	19.91	12.0	19.8	16.0	4.9	15
1986	9	6	.0	2446679.5	11	12.056	- 8	10.22	11	13.882	- 8	22.02	4.25	24.64	3.29	19.88	12.1	19.8	15.5	4.7	17
1986	9	7	.0	2446680.5	11	12.629	- 8	14.73	11	14.456	- 8	26.54	4.26	24.16	3.30	19.85	12.1	19.8	15.1	4.6	27
1986	9	8	.0	2446681.5	11	13.200	- 8	19.27	11	15.027	- 8	31.08	4.28	23.68	3.31	19.82	12.1	19.9	14.6	4.4	39
1986	9	9	.0	2446682.5	11	13.768	- 8	23.83	11	15.595	- 8	35.65	4.29	23.20	3.32	19.79	12.1	19.9	14.2	4.3	52
1986	9	10	.0	2446683.5	11	14.333	- 8	28.42	11	16.160	- 8	40.24	4.30	22.72	3.34	19.76	12.1	19.9	13.8	4.1	65
1986	9	11	.0	2446684.5	11	14.895	- 8	33.02	11	16.722	- 8	44.86	4.32	22.24	3.35	19.73	12.1	19.9	13.5	4.0	79
1986	9	12	.0	2446685.5	11	15.454	- 8	37.65	11	17.281	- 8	49.49	4.33	21.76	3.36	19.70	12.2	19.9	13.2	3.9	92
1986	9	13	.0	2446686.5	11	16.010	- 8	42.30	11	17.837	- 8	54.15	4.34	21.28	3.37	19.67	12.2	19.9	13.0	3.8	106
1986	9	14	.0	2446687.5	11	16.562	- 8	46.97	11	18.390	- 8	58.82	4.35	20.80	3.38	19.64	12.2	19.9	12.8	3.8	119
1986	9	15	.0	2446688.5	11	17.111	- 8	51.66	11	18.939	- 9	3.52	4.37	20.32	3.39	19.61	12.2	20.0	12.6	3.7	132
1986	9	16	.0	2446689.5	11	17.656	- 8	56.37	11	19.485	- 9	8.23	4.38	19.84	3.40	19.58	12.2	20.0	12.5	3.7	145
1986	9	17	.0	2446690.5	11	18.198	- 9	1.10	11	20.027	- 9	12.96	4.39	19.36	3.41	19.55	12.2	20.0	12.4	3.6	156
1986	9	18	.0	2446691.5	11	18.736	- 9	5.84	11	20.565	- 9	17.71	4.40	18.87	3.43	19.52	12.3	20.0	12.4	3.6	164
1986	9	19	.0	2446692.5	11	19.271	- 9	10.60	11	21.100	- 9	22.48	4.41	18.39	3.44	19.50	12.3	20.0	12.5	3.6	163
1986	9	20	.0	2446693.5	11	19.801	- 9	15.38	11	21.630	- 9	27.26	4.42	17.91	3.45	19.47	12.3	20.0	12.6	3.6	154
1986	9	21	.0	2446694.5	11	20.328	- 9	20.18	11	22.157	- 9	32.06	4.43	17.43	3.46	19.44	12.3	20.0	12.8	3.7	143
1986	9	22	.0	2446695.5	11	20.851	- 9	24.98	11	22.680	- 9	36.87	4.44	16.95	3.47	19.41	12.3	20.0	13.0	3.7	131
1986	9	23	.0	2446696.5	11	21.369	- 9	29.81	11	23.199	- 9	41.70	4.45	16.47	3.48	19.38	12.3	20.1	13.2	3.8	120
1986	9	24	.0	2446697.5	11	21.883	- 9	34.65	11	23.713	- 9	46.54	4.46	15.98	3.49	19.35	12.4	20.1	13.5	3.9	109
1986	9	25	.0	2446698.5	11	22.393	- 9	39.50	11	24.224	- 9	51.40	4.47	15.50	3.50	19.33	12.4	20.1	13.9	3.9	97
1986	9	26	.0	2446699.5	11	22.899	- 9	44.36	11	24.730	- 9	56.27	4.48	15.02	3.52	19.30	12.4	20.1	14.3	4.0	86
1986	9	27	.0	2446700.5	11	23.400	- 9	49.24	11	25.231	-10	1.15	4.49	14.53	3.53	19.27	12.4	20.1	14.7	4.1	75
1986	9	28	.0	2446701.5	11	23.896	- 9	54.13	11	25.728	-10	6.04	4.50	14.05	3.54	19.24	12.4	20.1	15.2	4.2	63
1986	9	29	.0	2446702.5	11	24.388	- 9	59.03	11	26.220	-10	10.95	4.50	13.56	3.55	19.21	12.4	20.1	15.6	4.4	52
1986	9	30	.0	2446703.5	11	24.875	-10	3.94	11	26.707	-10	15.86	4.51	13.08	3.56	19.19	12.4	20.1	16.2	4.5	40
1986	10	1	.0	2446704.5	11	25.356	-10	8.86	11	27.189	-10	20.79	4.52	12.60	3.57	19.16	12.5	20.1	16.7	4.6	29
1986	10	2	.0	2446705.5	11	25.833	-10	13.79	11	27.665	-10	25.72	4.53	12.12	3.58	19.13	12.5	20.1	17.3	4.8	19
1986	10	3	.0	2446706.5	11	26.304	-10	18.72	11	28.137	-10	30.66	4.53	11.63	3.59	19.11	12.5	20.2	17.9	4.9	14
1986	10	4	.0	2446707.5	11	26.770	-10	23.67	11	28.603	-10	35.61	4.54	11.15	3.60	19.08	12.5	20.2	18.5	5.0	20
1986	10	5	.0	2446708.5	11	27.230	-10	28.62	11	29.064	-10	40.56	4.55	10.67	3.62	19.05	12.5	20.2	19.1	5.2	31
1986	10	6	.0	2446709.5	11	27.685	-10	33.57	11	29.519	-10	45.52	4.55	10.20	3.63	19.03	12.5	20.2	19.8	5.3	44
1986	10	7	.0	2446710.5	11	28.134	-10	38.53	11	29.968	-10	50.48	4.56	9.72	3.64	19.00	12.5	20.2	20.4	5.5	58
1986	10	8	.0	2446711.5	11	28.577	-10	43.50	11	30.411	-10	55.45	4.56	9.24	3.65	18.97	12.6	20.2	21.1	5.7	71
1986	10	9	.0	2446712.5	11	29.014	-10	48.46	11	30.848	-11	.42	4.57	8.77	3.66	18.95	12.6	20.2	21.8	5.8	85
1986	10	10	.0	2446713.5	11	29.444	-10	53.43	11	31.279	-11	5.40	4.57	8.30	3.67	18.92	12.6	20.2	22.5	6.0	99
1986	10	11	.0	2446714.5	11	29.868	-10	58.40	11	31.704	-11	10.37	4.58	7.83	3.68	18.89	12.6	20.2	23.2	6.1	112
1986	10	12	.0	2446715.5	11	30.286	-11	3.38	11	32.122	-11	15.35	4.58	7.37	3.69	18.87	12.6	20.2	23.9	6.3	125
1986	10	13	.0	2446716.5	11	30.697	-11	8.35	11	32.534	-11	20.32	4.59	6.91	3.70	18.84	12.6	20.2	24.7	6.5	138
1986	10	14	.0	2446717.5	11	31.102	-11	13.32	11	32.939	-11	25.29	4.59	6.45	3.71	18.82	12.6	20.3	25.4	6.6	150
1986	10	15	.0	2446718.5	11	31.500	-11	18.28	11	33.337	-11	30.26	4.59	5.99	3.72	18.79	12.6	20.3	26.2	6.8	160
1986	10	16	.0	2446719.5	11	31.891	-11	23.25	11	33.728	-11	35.23	4.60	5.53	3.74	18.77	12.6	20.3	26.9	6.9	164

YR	MN	DY	HR	J.D.	R.A. (1950)	DEC.	R.A. APPN	DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1986	10	17	.0	2446720.5	11 32.274	-11 28.21	11 34.112	-11 40.20	4.60	5.08	3.75	18.74	12.7	20.3	27.7	7.1	159
1986	10	18	.0	2446721.5	11 32.651	-11 33.17	11 34.489	-11 45.16	4.60	4.63	3.76	18.72	12.7	20.3	28.5	7.3	150
1986	10	19	.0	2446722.5	11 33.021	-11 38.13	11 34.859	-11 50.12	4.61	4.18	3.77	18.69	12.7	20.3	29.3	7.4	139
1986	10	20	.0	2446723.5	11 33.383	-11 43.08	11 35.221	-11 55.07	4.61	3.73	3.78	18.67	12.7	20.3	30.1	7.6	127
1986	10	21	.0	2446724.5	11 33.737	-11 48.03	11 35.576	-12 .02	4.61	3.29	3.79	18.64	12.7	20.3	30.9	7.7	116
1986	10	22	.0	2446725.5	11 34.084	-11 52.96	11 35.924	-12 4.97	4.61	2.84	3.80	18.62	12.7	20.3	31.7	7.9	105
1986	10	23	.0	2446726.5	11 34.423	-11 57.90	11 36.263	-12 9.90	4.61	2.40	3.81	18.59	12.7	20.3	32.5	8.1	93
1986	10	24	.0	2446727.5	11 34.754	-12 2.82	11 36.595	-12 14.83	4.61	1.97	3.82	18.57	12.7	20.3	33.3	8.2	82
1986	10	25	.0	2446728.5	11 35.077	-12 7.74	11 36.919	-12 19.75	4.61	1.53	3.83	18.54	12.7	20.3	34.1	8.4	71
1986	10	26	.0	2446729.5	11 35.392	-12 12.65	11 37.234	-12 24.66	4.62	1.10	3.84	18.52	12.8	20.3	34.9	8.5	59
1986	10	27	.0	2446730.5	11 35.699	-12 17.54	11 37.541	-12 29.56	4.62	.67	3.85	18.49	12.8	20.4	35.8	8.7	48
1986	10	28	.0	2446731.5	11 35.997	-12 22.43	11 37.839	-12 34.45	4.62	.24	3.86	18.47	12.8	20.4	36.6	8.8	37
1986	10	29	.0	2446732.5	11 36.286	-12 27.30	11 38.129	-12 39.32	4.62	-.18	3.88	18.45	12.8	20.4	37.4	9.0	26
1986	10	30	.0	2446733.5	11 36.566	-12 32.16	11 38.410	-12 44.19	4.62	-.60	3.89	18.42	12.8	20.4	38.3	9.1	17
1986	10	31	.0	2446734.5	11 36.838	-12 37.01	11 38.681	-12 49.04	4.62	-1.01	3.90	18.40	12.8	20.4	39.1	9.3	16
1986	11	1	.0	2446735.5	11 37.100	-12 41.84	11 38.944	-12 53.87	4.62	-1.42	3.91	18.37	12.8	20.4	40.0	9.4	24
1986	11	2	.0	2446736.5	11 37.352	-12 46.66	11 39.197	-12 58.69	4.61	-1.83	3.92	18.35	12.8	20.4	40.9	9.5	36
1986	11	3	.0	2446737.5	11 37.596	-12 51.46	11 39.441	-13 3.49	4.61	-2.23	3.93	18.33	12.8	20.4	41.7	9.7	50
1986	11	4	.0	2446738.5	11 37.829	-12 56.24	11 39.675	-13 8.27	4.61	-2.63	3.94	18.30	12.8	20.4	42.6	9.8	64
1986	11	5	.0	2446739.5	11 38.053	-13 1.00	11 39.899	-13 13.04	4.61	-3.02	3.95	18.28	12.8	20.4	43.4	9.9	78
1986	11	6	.0	2446740.5	11 38.266	-13 5.74	11 40.113	-13 17.78	4.61	-3.41	3.96	18.26	12.8	20.4	44.3	10.1	92
1986	11	7	.0	2446741.5	11 38.470	-13 10.46	11 40.317	-13 22.50	4.61	-3.79	3.97	18.23	12.9	20.4	45.2	10.2	106
1986	11	8	.0	2446742.5	11 38.663	-13 15.15	11 40.510	-13 27.20	4.60	-4.16	3.98	18.21	12.9	20.4	46.1	10.3	119
1986	11	9	.0	2446743.5	11 38.845	-13 19.82	11 40.693	-13 31.88	4.60	-4.53	3.99	18.19	12.9	20.4	47.0	10.5	132
1986	11	10	.0	2446744.5	11 39.017	-13 24.47	11 40.866	-13 36.53	4.60	-4.90	4.00	18.17	12.9	20.4	47.9	10.6	144
1986	11	11	.0	2446745.5	11 39.178	-13 29.09	11 41.027	-13 41.15	4.60	-5.26	4.01	18.14	12.9	20.4	48.7	10.7	155
1986	11	12	.0	2446746.5	11 39.328	-13 33.69	11 41.177	-13 45.74	4.59	-5.61	4.02	18.12	12.9	20.4	49.6	10.8	162
1986	11	13	.0	2446747.5	11 39.467	-13 38.25	11 41.317	-13 50.31	4.59	-5.96	4.03	18.10	12.9	20.4	50.5	10.9	162
1986	11	14	.0	2446748.5	11 39.594	-13 42.79	11 41.445	-13 54.85	4.59	-6.30	4.04	18.08	12.9	20.4	51.5	11.0	154
1986	11	15	.0	2446749.5	11 39.711	-13 47.29	11 41.561	-13 59.36	4.58	-6.63	4.05	18.05	12.9	20.4	52.4	11.1	144
1986	11	16	.0	2446750.5	11 39.815	-13 51.77	11 41.667	-14 3.84	4.58	-6.96	4.06	18.03	12.9	20.4	53.3	11.2	133
1986	11	17	.0	2446751.5	11 39.908	-13 56.21	11 41.760	-14 8.28	4.57	-7.29	4.08	18.01	12.9	20.5	54.2	11.3	122
1986	11	18	.0	2446752.5	11 39.989	-14 .62	11 41.842	-14 12.70	4.57	-7.60	4.09	17.99	12.9	20.5	55.1	11.4	110
1986	11	19	.0	2446753.5	11 40.058	-14 5.00	11 41.911	-14 17.07	4.57	-7.92	4.10	17.97	12.9	20.5	56.0	11.5	99
1986	11	20	.0	2446754.5	11 40.115	-14 9.34	11 41.969	-14 21.42	4.56	-8.22	4.11	17.94	12.9	20.5	57.0	11.6	88
1986	11	21	.0	2446755.5	11 40.160	-14 13.64	11 42.013	-14 25.72	4.56	-8.52	4.12	17.92	13.0	20.5	57.9	11.7	76
1986	11	22	.0	2446756.5	11 40.192	-14 17.91	11 42.046	-14 29.99	4.55	-8.82	4.13	17.90	13.0	20.5	58.8	11.8	65
1986	11	23	.0	2446757.5	11 40.211	-14 22.13	11 42.065	-14 34.22	4.55	-9.10	4.14	17.88	13.0	20.5	59.8	11.9	54
1986	11	24	.0	2446758.5	11 40.217	-14 26.32	11 42.072	-14 38.40	4.54	-9.38	4.15	17.86	13.0	20.5	60.7	12.0	43
1986	11	25	.0	2446759.5	11 40.210	-14 30.46	11 42.066	-14 42.55	4.53	-9.66	4.16	17.84	13.0	20.5	61.7	12.1	32
1986	11	26	.0	2446760.5	11 40.190	-14 34.56	11 42.046	-14 46.65	4.53	-9.92	4.17	17.81	13.0	20.5	62.6	12.1	22
1986	11	27	.0	2446761.5	11 40.156	-14 38.61	11 42.013	-14 50.70	4.52	-10.18	4.18	17.79	13.0	20.5	63.6	12.2	17
1986	11	28	.0	2446762.5	11 40.109	-14 42.62	11 41.966	-14 54.71	4.52	-10.43	4.19	17.77	13.0	20.5	64.5	12.3	20
1986	11	29	.0	2446763.5	11 40.048	-14 46.57	11 41.905	-14 58.67	4.51	-10.67	4.20	17.75	13.0	20.5	65.5	12.3	30
1986	11	30	.0	2446764.5	11 39.973	-14 50.48	11 41.830	-15 2.58	4.50	-10.91	4.21	17.73	13.0	20.5	66.5	12.4	42
1986	12	1	.0	2446765.5	11 39.884	-14 54.34	11 41.742	-15 6.44	4.50	-11.13	4.22	17.71	13.0	20.5	67.4	12.5	56
1986	12	2	.0	2446766.5	11 39.781	-14 58.14	11 41.639	-15 10.24	4.49	-11.35	4.23	17.69	13.0	20.5	68.4	12.5	70
1986	12	3	.0	2446767.5	11 39.662	-15 1.89	11 41.521	-15 13.99	4.49	-11.56	4.24	17.67	13.0	20.5	69.4	12.6	85
1986	12	4	.0	2446768.5	11 39.530	-15 5.57	11 41.389	-15 17.68	4.48	-11.76	4.25	17.65	13.0	20.5	70.4	12.6	99
1986	12	5	.0	2446769.5	11 39.382	-15 9.20	11 41.242	-15 21.32	4.47	-11.94	4.26	17.63	13.0	20.5	71.4	12.7	113

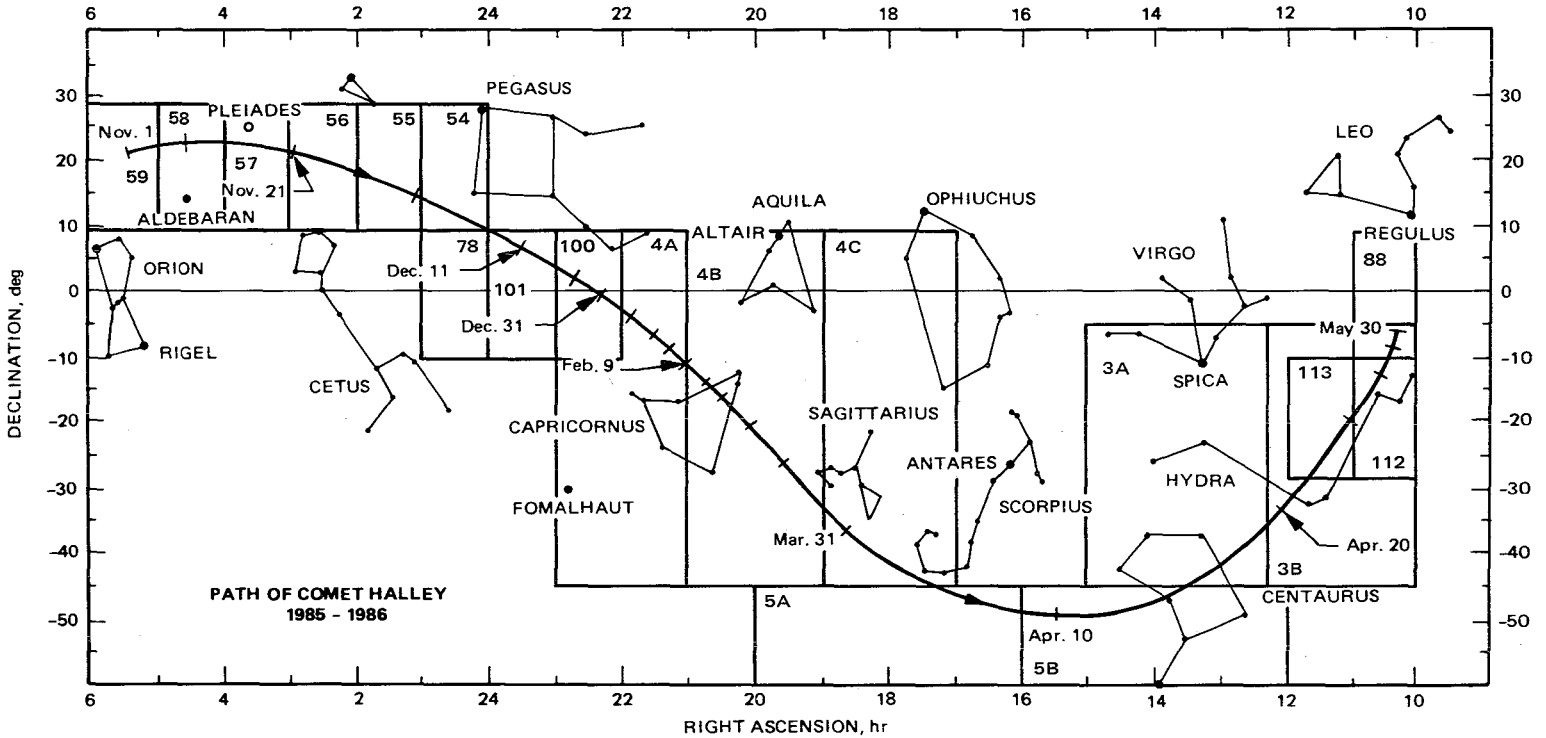
YR	MN	DY	HR	J.D.	R.A. (1950)	DEC.	R.A. APPN	DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1986	12	6	.0	2446770.5	11 39.220	-15 12.77	11 41.080	-15 24.89	4.46	-12.12	4.27	17.61	13.0	20.5	72.3	12.7	127
1986	12	7	.0	2446771.5	11 39.042	-15 16.28	11 40.902	-15 28.40	4.46	-12.29	4.28	17.58	13.0	20.5	73.3	12.7	140
1986	12	8	.0	2446772.5	11 38.849	-15 19.72	11 40.710	-15 31.84	4.45	-12.45	4.29	17.56	13.0	20.5	74.3	12.8	151
1986	12	9	.0	2446773.5	11 38.641	-15 23.10	11 40.502	-15 35.22	4.44	-12.60	4.30	17.54	13.0	20.5	75.3	12.8	160
1986	12	10	.0	2446774.5	11 38.417	-15 26.41	11 40.278	-15 38.53	4.44	-12.74	4.31	17.52	13.0	20.5	76.3	12.8	161
1986	12	11	.0	2446775.5	11 38.178	-15 29.65	11 40.039	-15 41.77	4.43	-12.87	4.32	17.50	13.1	20.5	77.3	12.8	156
1986	12	12	.0	2446776.5	11 37.923	-15 32.82	11 39.784	-15 44.94	4.42	-12.99	4.33	17.48	13.1	20.5	78.4	12.9	146
1986	12	13	.0	2446777.5	11 37.652	-15 35.92	11 39.514	-15 48.04	4.41	-13.10	4.34	17.46	13.1	20.5	79.4	12.9	135
1986	12	14	.0	2446778.5	11 37.365	-15 38.94	11 39.227	-15 51.06	4.41	-13.20	4.35	17.44	13.1	20.5	80.4	12.9	124
1986	12	15	.0	2446779.5	11 37.063	-15 41.89	11 38.925	-15 54.01	4.40	-13.29	4.36	17.42	13.1	20.5	81.4	12.9	113
1986	12	16	.0	2446780.5	11 36.744	-15 44.75	11 38.606	-15 56.88	4.39	-13.37	4.37	17.40	13.1	20.5	82.4	12.9	102
1986	12	17	.0	2446781.5	11 36.408	-15 47.54	11 38.271	-15 59.67	4.38	-13.44	4.38	17.38	13.1	20.5	83.5	12.9	91
1986	12	18	.0	2446782.5	11 36.057	-15 50.25	11 37.920	-16 2.38	4.38	-13.50	4.39	17.36	13.1	20.5	84.5	12.9	79
1986	12	19	.0	2446783.5	11 35.688	-15 52.88	11 37.552	-16 5.01	4.37	-13.55	4.40	17.35	13.1	20.5	85.5	12.9	68
1986	12	20	.0	2446784.5	11 35.304	-15 55.41	11 37.167	-16 7.55	4.36	-13.59	4.41	17.33	13.1	20.5	86.6	12.9	57
1986	12	21	.0	2446785.5	11 34.902	-15 57.87	11 36.766	-16 10.00	4.35	-13.62	4.42	17.31	13.1	20.5	87.6	12.8	46
1986	12	22	.0	2446786.5	11 34.484	-16 .23	11 36.348	-16 12.36	4.34	-13.64	4.43	17.29	13.1	20.5	88.7	12.8	35
1986	12	23	.0	2446787.5	11 34.049	-16 2.50	11 35.913	-16 14.63	4.34	-13.64	4.44	17.27	13.1	20.5	89.7	12.8	26
1986	12	24	.0	2446788.5	11 33.597	-16 4.67	11 35.461	-16 16.81	4.33	-13.64	4.45	17.25	13.1	20.5	90.8	12.8	19
1986	12	25	.0	2446789.5	11 33.128	-16 6.75	11 34.992	-16 18.89	4.32	-13.62	4.46	17.23	13.1	20.5	91.8	12.7	20
1986	12	26	.0	2446790.5	11 32.642	-16 8.74	11 34.506	-16 20.87	4.31	-13.60	4.47	17.21	13.1	20.5	92.9	12.7	27
1986	12	27	.0	2446791.5	11 32.139	-16 10.62	11 34.003	-16 22.75	4.30	-13.56	4.48	17.19	13.1	20.5	94.0	12.6	39
1986	12	28	.0	2446792.5	11 31.619	-16 12.40	11 33.483	-16 24.53	4.30	-13.50	4.49	17.17	13.1	20.5	95.1	12.6	51
1986	12	29	.0	2446793.5	11 31.082	-16 14.07	11 32.945	-16 26.21	4.29	-13.44	4.50	17.15	13.1	20.5	96.1	12.5	65
1986	12	30	.0	2446794.5	11 30.527	-16 15.64	11 32.391	-16 27.78	4.28	-13.36	4.51	17.14	13.1	20.5	97.2	12.5	79
1986	12	31	.0	2446795.5	11 29.955	-16 17.10	11 31.819	-16 29.23	4.27	-13.27	4.52	17.12	13.1	20.5	98.3	12.4	94
1987	1	1	.0	2446796.5	11 29.366	-16 18.44	11 31.230	-16 30.58	4.27	-13.17	4.53	17.10	13.1	20.5	99.4	12.4	108
1987	1	2	.0	2446797.5	11 28.760	-16 19.67	11 30.624	-16 31.81	4.26	-13.05	4.54	17.08	13.1	20.5	100.5	12.3	123
1987	1	3	.0	2446798.5	11 28.136	-16 20.79	11 30.000	-16 32.93	4.25	-12.92	4.55	17.06	13.1	20.5	101.5	12.2	136
1987	1	4	.0	2446799.5	11 27.496	-16 21.78	11 29.360	-16 33.92	4.24	-12.78	4.56	17.04	13.1	20.5	102.6	12.1	148
1987	1	5	.0	2446800.5	11 26.838	-16 22.66	11 28.702	-16 34.80	4.24	-12.62	4.57	17.02	13.1	20.5	103.7	12.1	157
1987	1	6	.0	2446801.5	11 26.164	-16 23.42	11 28.027	-16 35.55	4.23	-12.45	4.58	17.01	13.1	20.5	104.8	12.0	160
1987	1	7	.0	2446802.5	11 25.473	-16 24.05	11 27.336	-16 36.18	4.22	-12.27	4.59	16.99	13.2	20.5	105.9	11.9	155
1987	1	8	.0	2446803.5	11 24.765	-16 24.55	11 26.628	-16 36.68	4.21	-12.08	4.60	16.97	13.2	20.5	107.0	11.8	146
1987	1	9	.0	2446804.5	11 24.041	-16 24.93	11 25.904	-16 37.06	4.21	-11.87	4.61	16.95	13.2	20.5	108.1	11.7	135
1987	1	10	.0	2446805.5	11 23.300	-16 25.18	11 25.163	-16 37.31	4.20	-11.66	4.62	16.93	13.2	20.5	109.3	11.6	124
1987	1	11	.0	2446806.5	11 22.543	-16 25.30	11 24.406	-16 37.43	4.19	-11.43	4.63	16.92	13.2	20.5	110.4	11.5	113
1987	1	12	.0	2446807.5	11 21.770	-16 25.29	11 23.632	-16 37.41	4.19	-11.18	4.64	16.90	13.2	20.5	111.5	11.4	102
1987	1	13	.0	2446808.5	11 20.981	-16 25.14	11 22.843	-16 37.26	4.18	-10.93	4.65	16.88	13.2	20.5	112.6	11.3	91
1987	1	14	.0	2446809.5	11 20.176	-16 24.86	11 22.038	-16 36.98	4.18	-10.66	4.66	16.86	13.2	20.5	113.7	11.1	79
1987	1	15	.0	2446810.5	11 19.356	-16 24.44	11 21.218	-16 36.55	4.17	-10.38	4.67	16.84	13.2	20.5	114.8	11.0	68
1987	1	16	.0	2446811.5	11 18.520	-16 23.88	11 20.382	-16 35.99	4.16	-10.09	4.68	16.83	13.2	20.5	116.0	10.9	57
1987	1	17	.0	2446812.5	11 17.669	-16 23.19	11 19.530	-16 35.29	4.16	-9.79	4.69	16.81	13.2	20.5	117.1	10.8	46
1987	1	18	.0	2446813.5	11 16.803	-16 22.35	11 18.664	-16 34.45	4.15	-9.47	4.70	16.79	13.2	20.6	118.2	10.6	36
1987	1	19	.0	2446814.5	11 15.923	-16 21.36	11 17.783	-16 33.46	4.15	-9.14	4.71	16.77	13.2	20.6	119.3	10.5	27
1987	1	20	.0	2446815.5	11 15.028	-16 20.24	11 16.888	-16 32.32	4.14	-8.80	4.72	16.76	13.2	20.6	120.4	10.4	21
1987	1	21	.0	2446816.5	11 14.119	-16 18.97	11 15.978	-16 31.05	4.14	-8.45	4.73	16.74	13.2	20.6	121.6	10.2	22
1987	1	22	.0	2446817.5	11 13.196	-16 17.55	11 15.055	-16 29.62	4.13	-8.09	4.74	16.72	13.2	20.6	122.7	10.1	29
1987	1	23	.0	2446818.5	11 12.259	-16 15.98	11 14.118	-16 28.05	4.13	-7.71	4.75	16.70	13.2	20.6	123.8	9.9	39
1987	1	24	.0	2446819.5	11 11.310	-16 14.27	11 13.168	-16 26.33	4.12	-7.32	4.76	16.69	13.2	20.6	124.9	9.8	51

YR	MN	DY	HR	J.D.		R.A. (1950)		DEC.		R.A.	APPN	DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1987	1	25	.0	2446820.5	11	10.347	-16	12.40	11	12.205	-16	24.45	4.12	-6.92	4.76	16.67	13.2	20.6	126.1	9.6	64
1987	1	26	.0	2446821.5	11	9.372	-16	10.38	11	11.229	-16	22.43	4.11	-6.51	4.77	16.65	13.2	20.6	127.2	9.5	78
1987	1	27	.0	2446822.5	11	8.384	-16	8.22	11	10.242	-16	20.26	4.11	-6.08	4.78	16.64	13.2	20.6	128.3	9.3	92
1987	1	28	.0	2446823.5	11	7.385	-16	5.90	11	9.242	-16	17.93	4.11	-5.64	4.79	16.62	13.2	20.6	129.4	9.1	106
1987	1	29	.0	2446824.5	11	6.374	-16	3.42	11	8.231	-16	15.45	4.10	-5.19	4.80	16.60	13.2	20.6	130.6	9.0	120
1987	1	30	.0	2446825.5	11	5.352	-16	.80	11	7.209	-16	12.82	4.10	-4.73	4.81	16.59	13.2	20.6	131.7	8.8	134
1987	1	31	.0	2446826.5	11	4.320	-15	58.02	11	6.176	-16	10.03	4.10	-4.26	4.82	16.57	13.3	20.6	132.8	8.6	146
1987	2	1	.0	2446827.5	11	3.278	-15	55.09	11	5.133	-16	7.09	4.10	-3.77	4.83	16.55	13.3	20.6	133.9	8.5	155
1987	2	2	.0	2446828.5	11	2.226	-15	52.01	11	4.081	-16	4.00	4.09	-3.28	4.84	16.54	13.3	20.6	135.0	8.3	158
1987	2	3	.0	2446829.5	11	1.165	-15	48.78	11	3.020	-16	.76	4.09	-2.77	4.85	16.52	13.3	20.6	136.1	8.1	152
1987	2	4	.0	2446830.5	11	.096	-15	45.39	11	1.950	-15	57.36	4.09	-2.26	4.86	16.50	13.3	20.6	137.2	7.9	143
1987	2	5	.0	2446831.5	10	59.018	-15	41.86	11	.872	-15	53.82	4.09	-1.74	4.87	16.49	13.3	20.6	138.3	7.7	132
1987	2	6	.0	2446832.5	10	57.933	-15	38.18	10	59.786	-15	50.12	4.09	-1.20	4.88	16.47	13.3	20.6	139.3	7.6	121
1987	2	7	.0	2446833.5	10	56.841	-15	34.35	10	58.694	-15	46.28	4.09	-.66	4.89	16.45	13.3	20.6	140.4	7.4	110
1987	2	8	.0	2446834.5	10	55.743	-15	30.37	10	57.595	-15	42.29	4.09	-.11	4.90	16.44	13.3	20.6	141.5	7.2	99
1987	2	9	.0	2446835.5	10	54.639	-15	26.25	10	56.491	-15	38.16	4.09	.44	4.91	16.42	13.3	20.6	142.5	7.0	88
1987	2	10	.0	2446836.5	10	53.529	-15	21.99	10	55.380	-15	33.88	4.09	1.01	4.92	16.40	13.3	20.6	143.5	6.8	76
1987	2	11	.0	2446837.5	10	52.414	-15	17.58	10	54.265	-15	29.46	4.09	1.58	4.93	16.39	13.3	20.6	144.6	6.7	65
1987	2	12	.0	2446838.5	10	51.295	-15	13.03	10	53.146	-15	24.90	4.09	2.16	4.94	16.37	13.3	20.6	145.6	6.5	54
1987	2	13	.0	2446839.5	10	50.172	-15	8.35	10	52.023	-15	20.20	4.09	2.74	4.95	16.36	13.3	20.6	146.6	6.3	44
1987	2	14	.0	2446840.5	10	49.047	-15	3.53	10	50.897	-15	15.37	4.09	3.33	4.96	16.34	13.3	20.6	147.5	6.1	34
1987	2	15	.0	2446841.5	10	47.918	-14	58.58	10	49.768	-15	10.40	4.10	3.93	4.96	16.32	13.3	20.6	148.5	6.0	26
1987	2	16	.0	2446842.5	10	46.787	-14	53.49	10	48.636	-15	5.30	4.10	4.53	4.97	16.31	13.4	20.6	149.4	5.8	22
1987	2	17	.0	2446843.5	10	45.655	-14	48.28	10	47.504	-15	.07	4.10	5.14	4.98	16.29	13.4	20.7	150.3	5.6	25
1987	2	18	.0	2446844.5	10	44.522	-14	42.93	10	46.370	-14	54.71	4.10	5.76	4.99	16.28	13.4	20.7	151.2	5.5	33
1987	2	19	.0	2446845.5	10	43.388	-14	37.47	10	45.236	-14	49.23	4.11	6.38	5.00	16.26	13.4	20.7	152.0	5.3	44
1987	2	20	.0	2446846.5	10	42.255	-14	31.88	10	44.102	-14	43.62	4.11	7.00	5.01	16.24	13.4	20.7	152.9	5.2	55
1987	2	21	.0	2446847.5	10	41.122	-14	26.17	10	42.969	-14	37.90	4.12	7.63	5.02	16.23	13.4	20.7	153.6	5.0	68
1987	2	22	.0	2446848.5	10	39.990	-14	20.35	10	41.837	-14	32.06	4.12	8.26	5.03	16.21	13.4	20.7	154.4	4.9	81
1987	2	23	.0	2446849.5	10	38.861	-14	14.42	10	40.708	-14	26.11	4.13	8.90	5.04	16.20	13.4	20.7	155.1	4.7	94
1987	2	24	.0	2446850.5	10	37.733	-14	8.37	10	39.580	-14	20.05	4.13	9.54	5.05	16.18	13.4	20.7	155.7	4.6	108
1987	2	25	.0	2446851.5	10	36.609	-14	2.22	10	38.456	-14	13.88	4.14	10.19	5.06	16.17	13.4	20.7	156.3	4.5	121
1987	2	26	.0	2446852.5	10	35.488	-13	55.97	10	37.335	-14	7.61	4.14	10.83	5.07	16.15	13.4	20.7	156.9	4.4	134
1987	2	27	.0	2446853.5	10	34.371	-13	49.62	10	36.218	-14	1.24	4.15	11.48	5.08	16.14	13.4	20.7	157.4	4.3	146
1987	2	28	.0	2446854.5	10	33.260	-13	43.18	10	35.106	-13	54.78	4.16	12.13	5.09	16.12	13.5	20.7	157.8	4.2	154
1987	3	1	.0	2446855.5	10	32.153	-13	36.64	10	33.999	-13	48.22	4.16	12.79	5.10	16.11	13.5	20.7	158.1	4.2	156
1987	3	2	.0	2446856.5	10	31.052	-13	30.02	10	32.897	-13	41.58	4.17	13.44	5.11	16.09	13.5	20.7	158.4	4.1	150
1987	3	3	.0	2446857.5	10	29.957	-13	23.31	10	31.803	-13	34.85	4.18	14.09	5.11	16.08	13.5	20.7	158.6	4.0	140
1987	3	4	.0	2446858.5	10	28.870	-13	16.53	10	30.715	-13	28.05	4.19	14.74	5.12	16.06	13.5	20.8	158.8	4.0	129
1987	3	5	.0	2446859.5	10	27.789	-13	9.67	10	29.634	-13	21.17	4.20	15.39	5.13	16.04	13.5	20.8	158.9	4.0	118
1987	3	6	.0	2446860.5	10	26.717	-13	2.75	10	28.562	-13	14.23	4.20	16.04	5.14	16.03	13.5	20.8	158.9	4.0	106
1987	3	7	.0	2446861.5	10	25.653	-12	55.76	10	27.498	-13	7.21	4.21	16.68	5.15	16.01	13.5	20.8	158.8	4.0	95
1987	3	8	.0	2446862.5	10	24.598	-12	48.71	10	26.443	-13	.14	4.22	17.33	5.16	16.00	13.5	20.8	158.6	4.0	84
1987	3	9	.0	2446863.5	10	23.552	-12	41.60	10	25.397	-12	53.02	4.23	17.97	5.17	15.99	13.6	20.8	158.4	4.1	72
1987	3	10	.0	2446864.5	10	22.516	-12	34.44	10	24.361	-12	45.84	4.24	18.61	5.18	15.97	13.6	20.8	158.1	4.1	61
1987	3	11	.0	2446865.5	10	21.489	-12	27.23	10	23.334	-12	38.61	4.26	19.24	5.19	15.96	13.6	20.8	157.7	4.2	51
1987	3	12	.0	2446866.5	10	20.474	-12	19.98	10	22.319	-12	31.34	4.27	19.87	5.20	15.94	13.6	20.8	157.3	4.2	41
1987	3	13	.0	2446867.5	10	19.469	-12	12.69	10	21.314	-12	24.03	4.28	20.50	5.21	15.93	13.6	20.8	156.8	4.3	31
1987	3	14	.0	2446868.5	10	18.476	-12	5.37	10	20.321	-12	16.68	4.29	21.12	5.22	15.91	13.6	20.8	156.3	4.4	25
1987	3	15	.0	2446869.5	10	17.494	-11	58.01	10	19.339	-12	9.30	4.30	21.73	5.23	15.90	13.6	20.9	155.7	4.5	23

YR	MN	DY	HR	J.D.		R.A. (1950)		DEC.		R.A.	APPN	DEC.	DELTA	DELDOT	R	RDOT	TMAG	NMAG	THETA	BETA	MOON
1987	3	16	.0	2446870.5	10	16.524	-11	50.63	10	18.369	-12	1.90	4.32	22.35	5.23	15.88	13.6	20.9	155.1	4.6	28
1987	3	17	.0	2446871.5	10	15.567	-11	43.23	10	17.412	-11	54.48	4.33	22.95	5.24	15.87	13.6	20.9	154.4	4.7	37
1987	3	18	.0	2446872.5	10	14.622	-11	35.81	10	16.467	-11	47.04	4.34	23.56	5.25	15.85	13.7	20.9	153.7	4.8	48
1987	3	19	.0	2446873.5	10	13.690	-11	28.38	10	15.535	-11	39.58	4.36	24.15	5.26	15.84	13.7	20.9	152.9	4.9	60
1987	3	20	.0	2446874.5	10	12.771	-11	20.93	10	14.616	-11	32.11	4.37	24.74	5.27	15.82	13.7	20.9	152.2	5.1	73
1987	3	21	.0	2446875.5	10	11.865	-11	13.48	10	13.711	-11	24.64	4.38	25.33	5.28	15.81	13.7	20.9	151.3	5.2	86
1987	3	22	.0	2446876.5	10	10.974	-11	6.02	10	12.819	-11	17.17	4.40	25.91	5.29	15.80	13.7	20.9	150.5	5.3	99
1987	3	23	.0	2446877.5	10	10.096	-10	58.57	10	11.942	-11	9.70	4.41	26.48	5.30	15.78	13.7	20.9	149.7	5.5	112
1987	3	24	.0	2446878.5	10	9.232	-10	51.12	10	11.079	-11	2.23	4.43	27.05	5.31	15.77	13.7	21.0	148.8	5.6	125
1987	3	25	.0	2446879.5	10	8.383	-10	43.69	10	10.230	-10	54.77	4.45	27.61	5.32	15.75	13.8	21.0	147.9	5.7	137
1987	3	26	.0	2446880.5	10	7.549	-10	36.26	10	9.396	-10	47.32	4.46	28.16	5.33	15.74	13.8	21.0	147.0	5.9	148
1987	3	27	.0	2446881.5	10	6.729	-10	28.85	10	8.576	-10	39.89	4.48	28.71	5.34	15.72	13.8	21.0	146.0	6.0	155
1987	3	28	.0	2446882.5	10	5.925	-10	21.46	10	7.772	-10	32.48	4.50	29.25	5.34	15.71	13.8	21.0	145.1	6.1	155
1987	3	29	.0	2446883.5	10	5.135	-10	14.09	10	6.983	-10	25.10	4.51	29.78	5.35	15.70	13.8	21.0	144.1	6.3	148
1987	3	30	.0	2446884.5	10	4.361	-10	6.76	10	6.209	-10	17.74	4.53	30.30	5.36	15.68	13.8	21.0	143.2	6.4	138
1987	3	31	.0	2446885.5	10	3.603	- 9	59.45	10	5.451	-10	10.41	4.55	30.81	5.37	15.67	13.8	21.0	142.2	6.5	127
1987	4	1	.0	2446886.5	10	2.860	- 9	52.18	10	4.709	-10	3.12	4.57	31.31	5.38	15.65	13.8	21.1	141.2	6.7	115
1987	4	2	.0	2446887.5	10	2.134	- 9	44.94	10	3.982	- 9	55.86	4.58	31.80	5.39	15.64	13.9	21.1	140.2	6.8	104
1987	4	3	.0	2446888.5	10	1.423	- 9	37.75	10	3.272	- 9	48.65	4.60	32.29	5.40	15.63	13.9	21.1	139.2	6.9	92
1987	4	4	.0	2446889.5	10	.728	- 9	30.59	10	2.577	- 9	41.48	4.62	32.76	5.41	15.61	13.9	21.1	138.2	7.1	81
1987	4	5	.0	2446890.5	10	.049	- 9	23.49	10	1.898	- 9	34.36	4.64	33.22	5.42	15.60	13.9	21.1	137.2	7.2	69
1987	4	6	.0	2446891.5	9	59.386	- 9	16.44	10	1.236	- 9	27.29	4.66	33.68	5.43	15.59	13.9	21.1	136.2	7.3	59
1987	4	7	.0	2446892.5	9	58.739	- 9	9.43	10	.589	- 9	20.27	4.68	34.12	5.43	15.57	13.9	21.1	135.2	7.5	48
1987	4	8	.0	2446893.5	9	58.108	- 9	2.49	9	59.959	- 9	13.30	4.70	34.56	5.44	15.56	14.0	21.1	134.2	7.6	38
1987	4	9	.0	2446894.5	9	57.494	- 8	55.59	9	59.345	- 9	6.40	4.72	34.98	5.45	15.54	14.0	21.2	133.1	7.7	29
1987	4	10	.0	2446895.5	9	56.895	- 8	48.76	9	58.747	- 8	59.55	4.74	35.39	5.46	15.53	14.0	21.2	132.1	7.8	24
1987	4	11	.0	2446896.5	9	56.313	- 8	41.99	9	58.164	- 8	52.76	4.76	35.80	5.47	15.52	14.0	21.2	131.1	7.9	23
1987	4	12	.0	2446897.5	9	55.746	- 8	35.29	9	57.598	- 8	46.04	4.78	36.19	5.48	15.50	14.0	21.2	130.1	8.0	29
1987	4	13	.0	2446898.5	9	55.196	- 8	28.65	9	57.048	- 8	39.38	4.80	36.57	5.49	15.49	14.0	21.2	129.0	8.2	38
1987	4	14	.0	2446899.5	9	54.661	- 8	22.07	9	56.514	- 8	32.79	4.82	36.94	5.50	15.48	14.0	21.2	128.0	8.3	49
1987	4	15	.0	2446900.5	9	54.143	- 8	15.57	9	55.996	- 8	26.27	4.84	37.31	5.51	15.46	14.1	21.2	127.0	8.4	62
1987	4	16	.0	2446901.5	9	53.640	- 8	9.13	9	55.494	- 8	19.83	4.87	37.66	5.52	15.45	14.1	21.2	126.0	8.5	75
1987	4	17	.0	2446902.5	9	53.153	- 8	2.77	9	55.007	- 8	13.45	4.89	38.01	5.52	15.44	14.1	21.3	125.0	8.6	88
1987	4	18	.0	2446903.5	9	52.682	- 7	56.48	9	54.537	- 8	7.15	4.91	38.34	5.53	15.42	14.1	21.3	123.9	8.7	101
1987	4	19	.0	2446904.5	9	52.227	- 7	50.27	9	54.082	- 8	.92	4.93	38.67	5.54	15.41	14.1	21.3	122.9	8.8	114
1987	4	20	.0	2446905.5	9	51.787	- 7	44.14	9	53.643	- 7	54.78	4.95	38.98	5.55	15.40	14.1	21.3	121.9	8.8	127
1987	4	21	.0	2446906.5	9	51.363	- 7	38.08	9	53.219	- 7	48.70	4.98	39.29	5.56	15.38	14.1	21.3	120.9	8.9	139
1987	4	22	.0	2446907.5	9	50.954	- 7	32.10	9	52.810	- 7	42.71	5.00	39.58	5.57	15.37	14.2	21.3	119.9	9.0	150
1987	4	23	.0	2446908.5	9	50.561	- 7	26.20	9	52.417	- 7	36.80	5.02	39.87	5.58	15.36	14.2	21.3	118.8	9.1	156
1987	4	24	.0	2446909.5	9	50.182	- 7	20.38	9	52.039	- 7	30.97	5.05	40.14	5.59	15.35	14.2	21.4	117.8	9.2	156
1987	4	25	.0	2446910.5	9	49.819	- 7	14.65	9	51.677	- 7	25.22	5.07	40.41	5.60	15.33	14.2	21.4	116.8	9.2	149
1987	4	26	.0	2446911.5	9	49.471	- 7	9.00	9	51.329	- 7	19.56	5.09	40.66	5.60	15.32	14.2	21.4	115.8	9.3	138
1987	4	27	.0	2446912.5	9	49.138	- 7	3.43	9	50.996	- 7	13.99	5.12	40.91	5.61	15.31	14.2	21.4	114.8	9.4	127
1987	4	28	.0	2446913.5	9	48.820	- 6	57.95	9	50.679	- 7	8.50	5.14	41.14	5.62	15.29	14.3	21.4	113.8	9.4	115
1987	4	29	.0	2446914.5	9	48.517	- 6	52.56	9	50.376	- 7	3.09	5.16	41.36	5.63	15.28	14.3	21.4	112.8	9.5	103
1987	4	30	.0	2446915.5	9	48.228	- 6	47.25	9	50.087	- 6	57.78	5.19	41.57	5.64	15.27	14.3	21.4	111.8	9.5	92
1987	5	1	.0	2446916.5	9	47.954	- 6	42.03	9	49.813	- 6	52.55	5.21	41.78	5.65	15.26	14.3	21.4	110.8	9.6	80
1987	5	2	.0	2446917.5	9	47.694	- 6	36.90	9	49.554	- 6	47.41	5.24	41.97	5.66	15.24	14.3	21.5	109.8	9.6	69
1987	5	3	.0	2446918.5	9	47.448	- 6	31.86	9	49.308	- 6	42.37	5.26	42.14	5.67	15.23	14.3	21.5	108.8	9.7	58
1987	5	4	.0	2446919.5	9	47.216	- 6	26.91	9	49.077	- 6	37.41	5.28	42.31	5.67	15.22	14.3	21.5	107.8	9.7	48

3. THE PATH OF COMET HALLEY ON THE SKY, 1985 - 1986

CHART INDEX



Path of Comet Halley on the Celestial Sphere During November 1985-May 1986. The Charts from the AAVSO and BAA-Tirion Star Atlases Covering the Path are Shown. The Charts Have More Overlap than Indicated

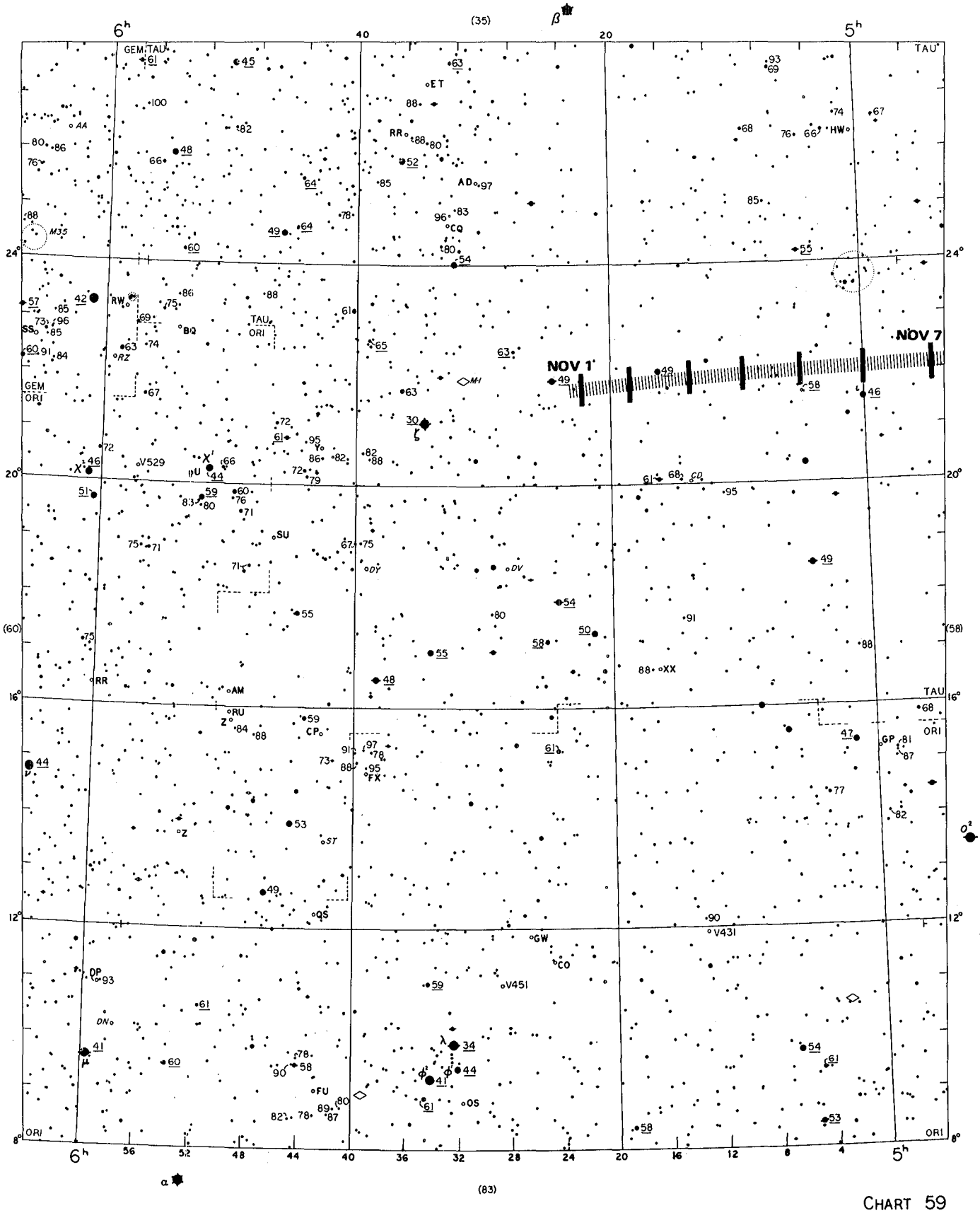


CHART 59

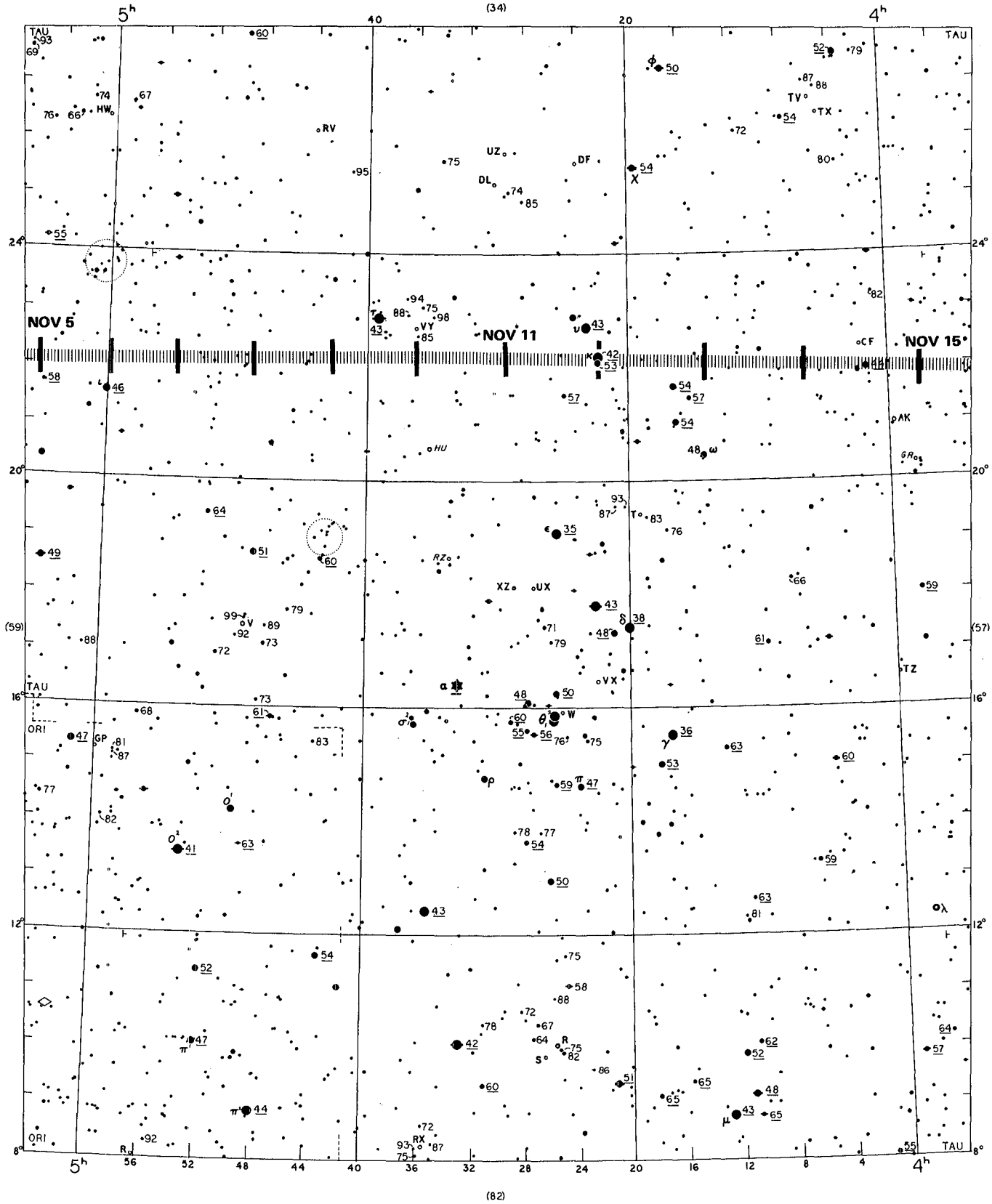


CHART 58

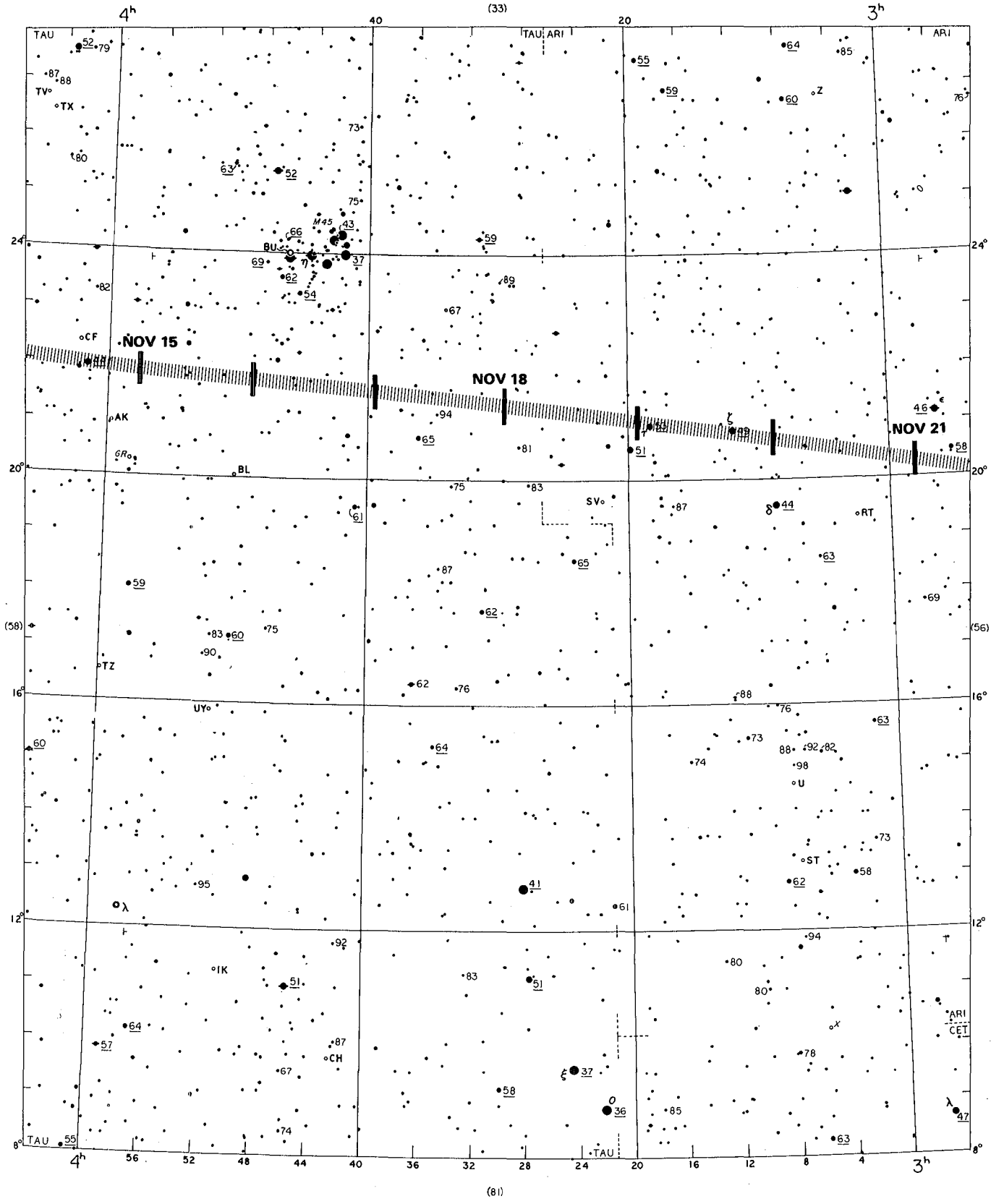


CHART 57

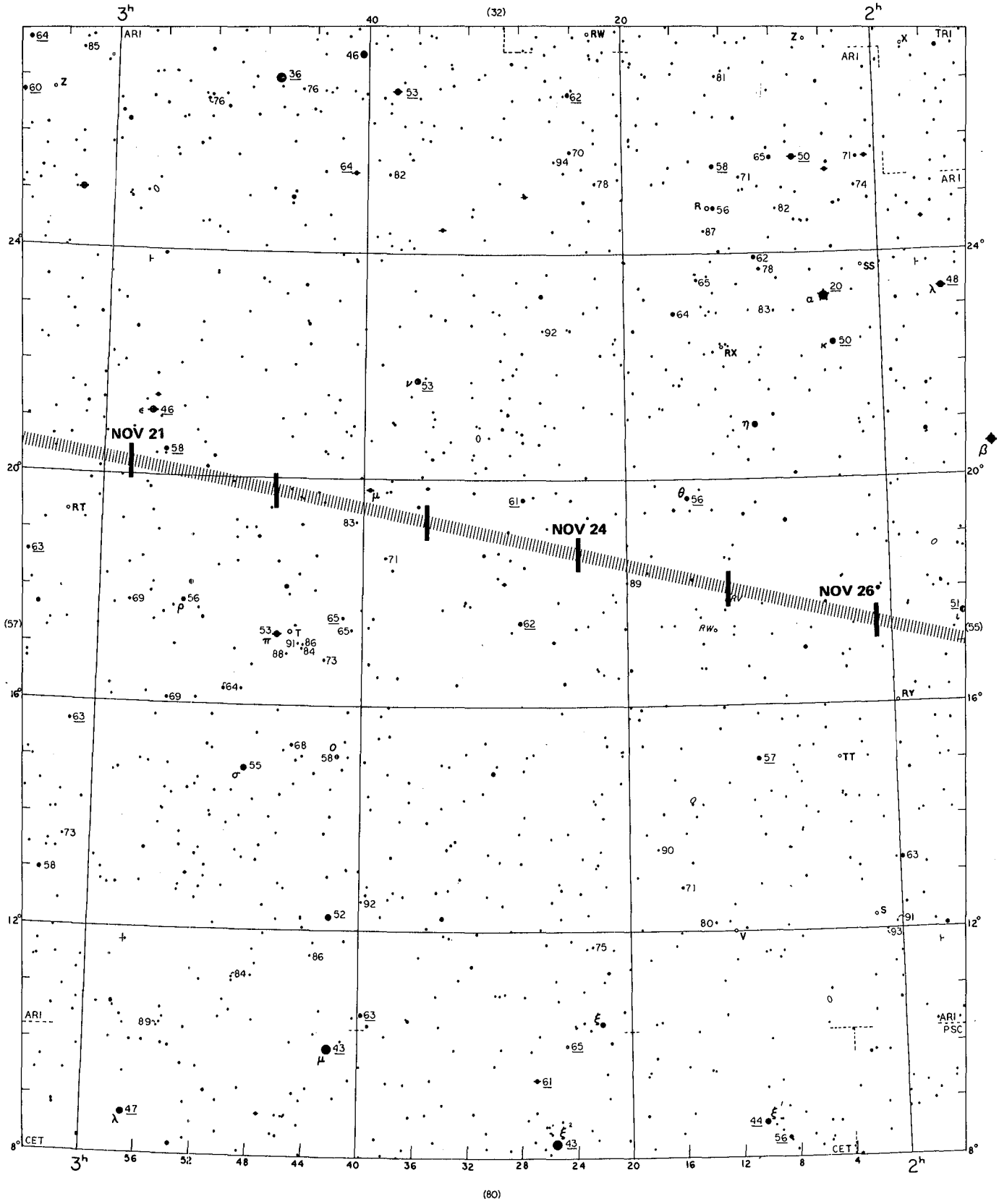


CHART 56

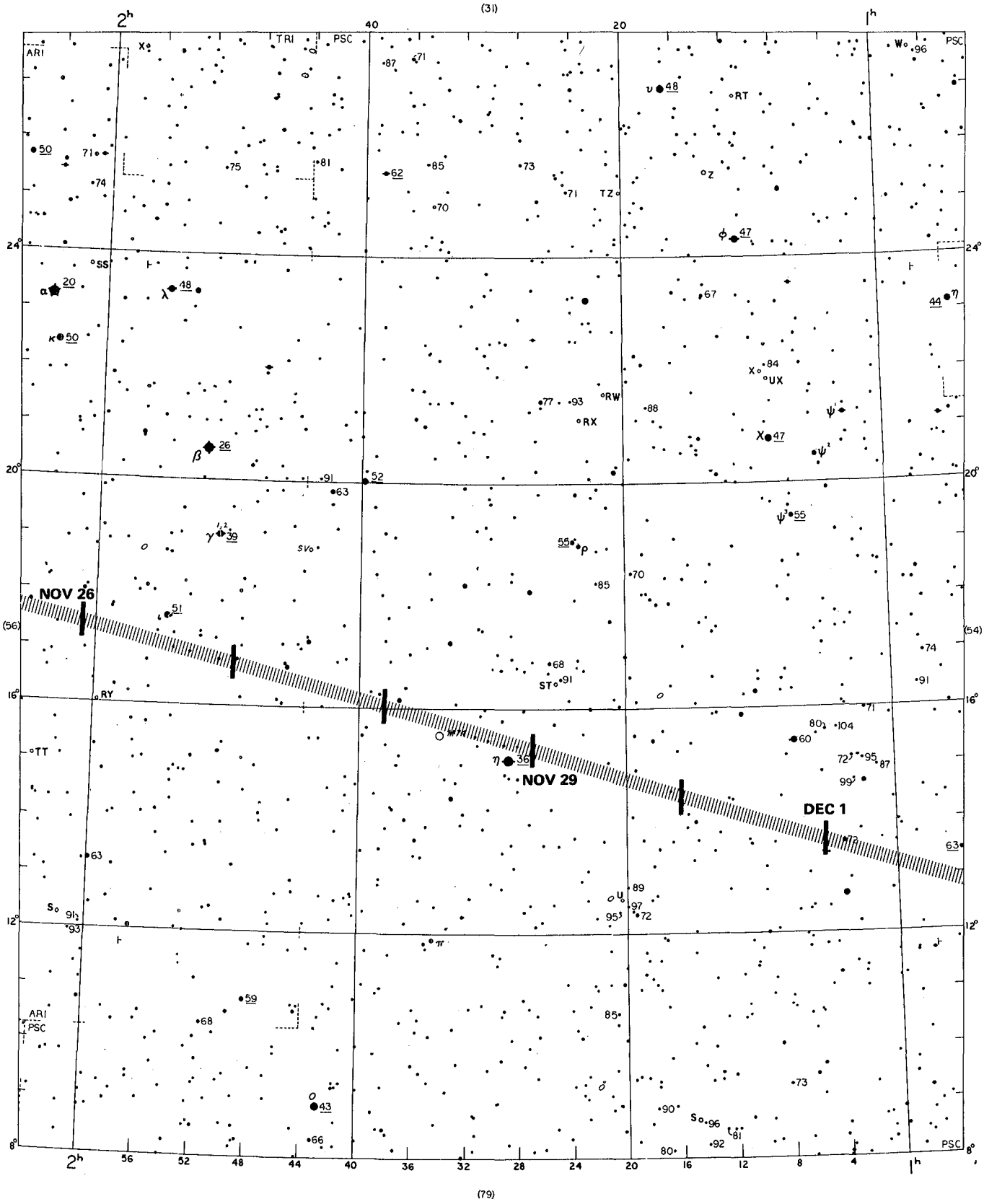


CHART 55

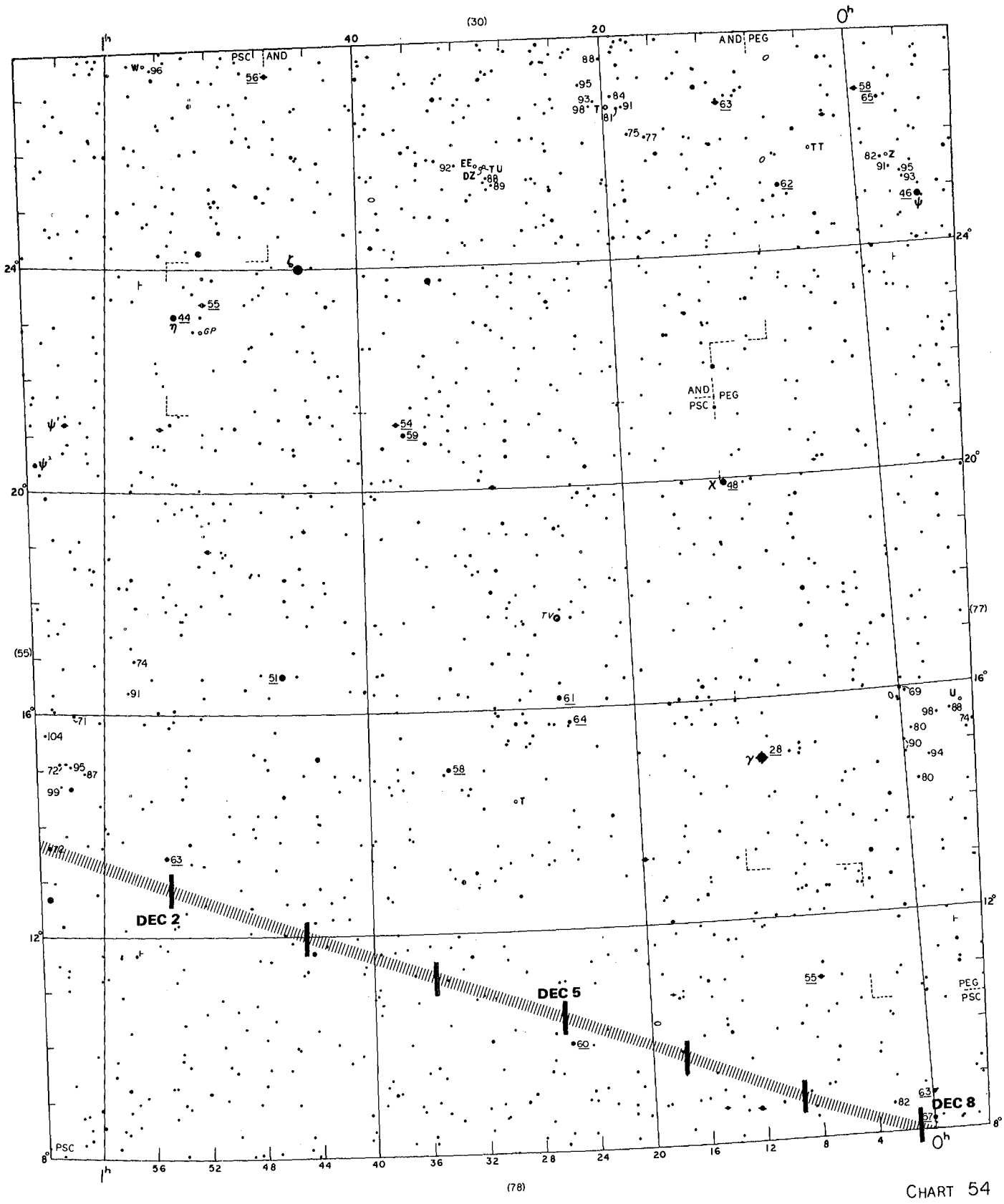


CHART 54

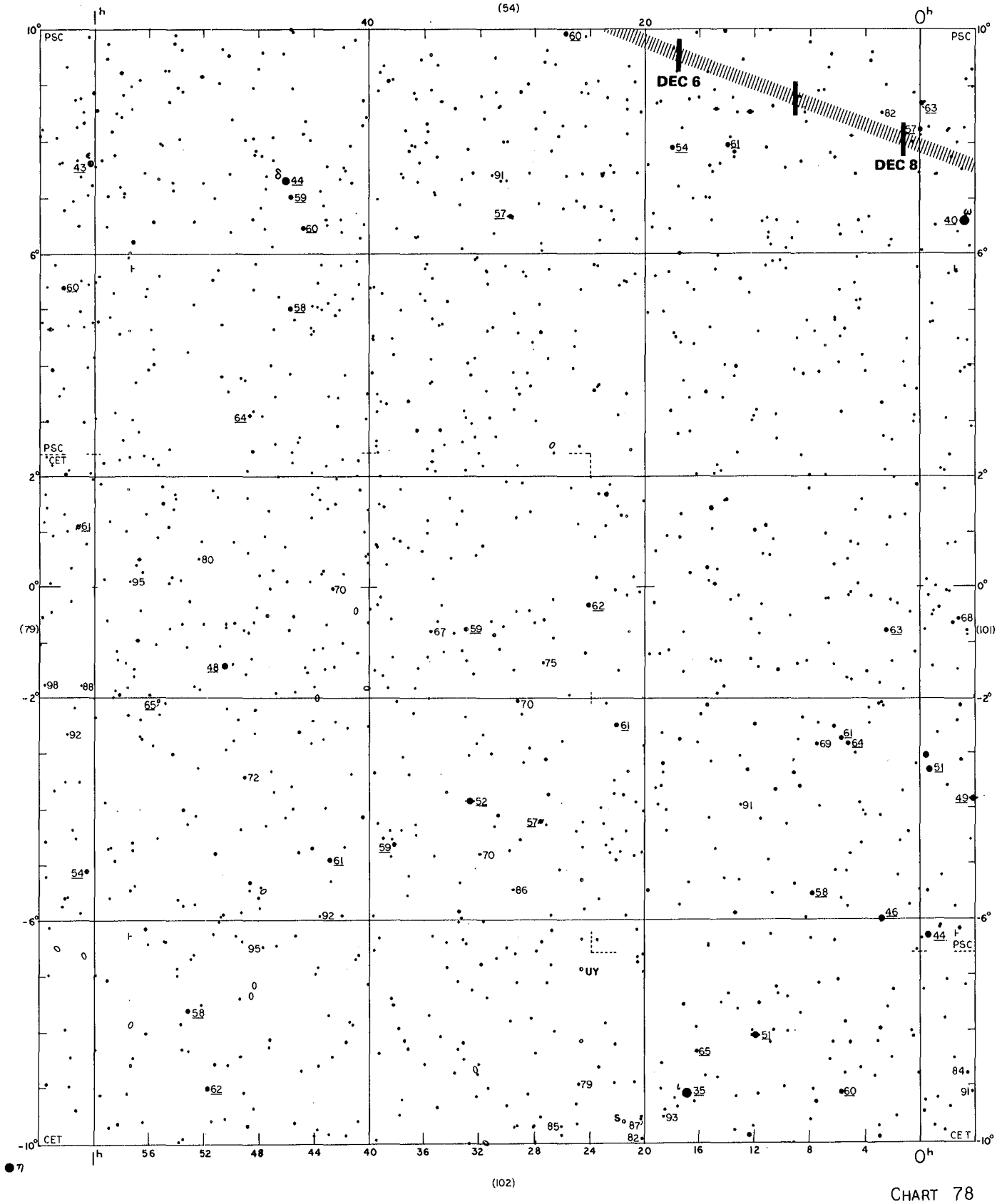


CHART 78

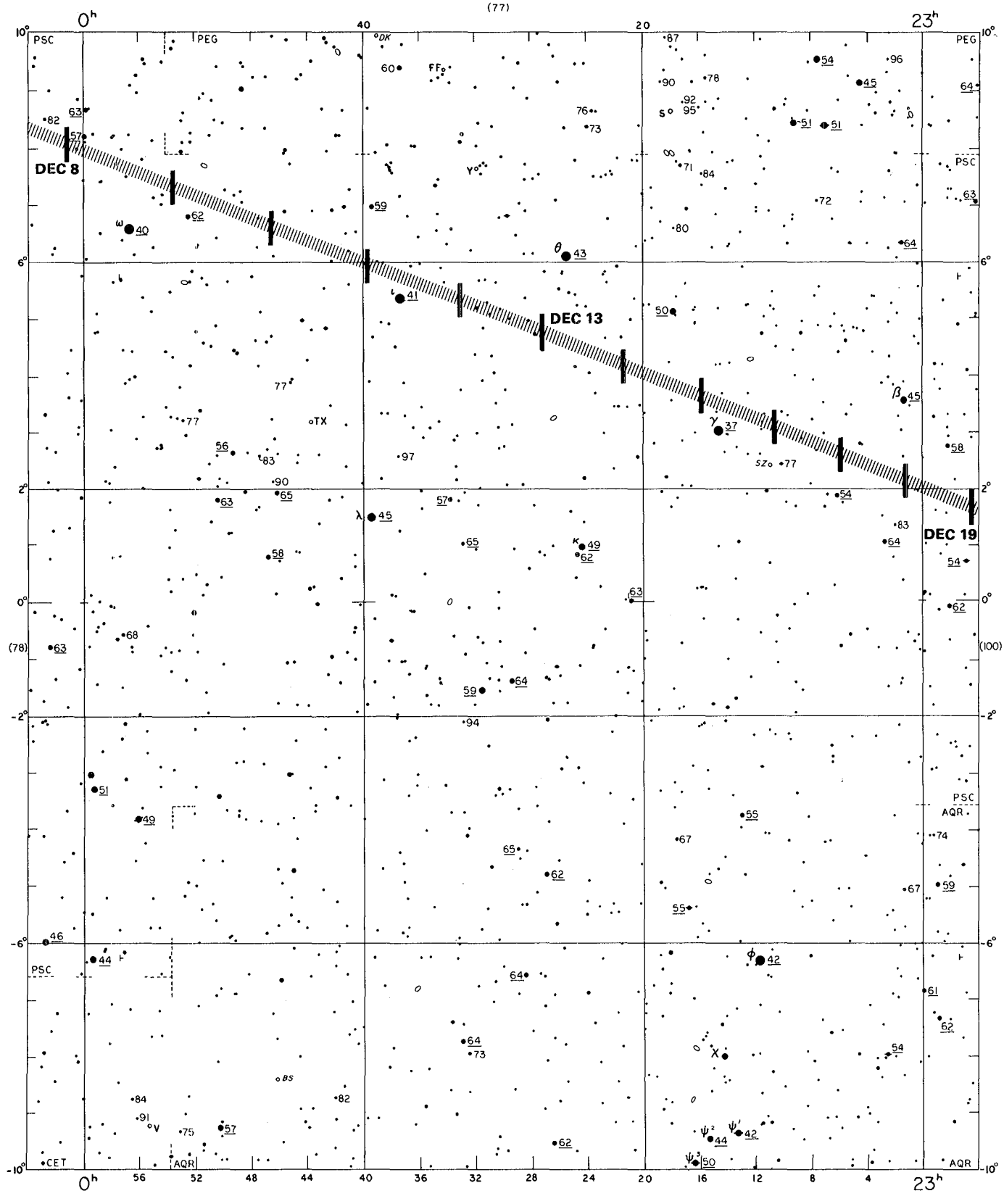
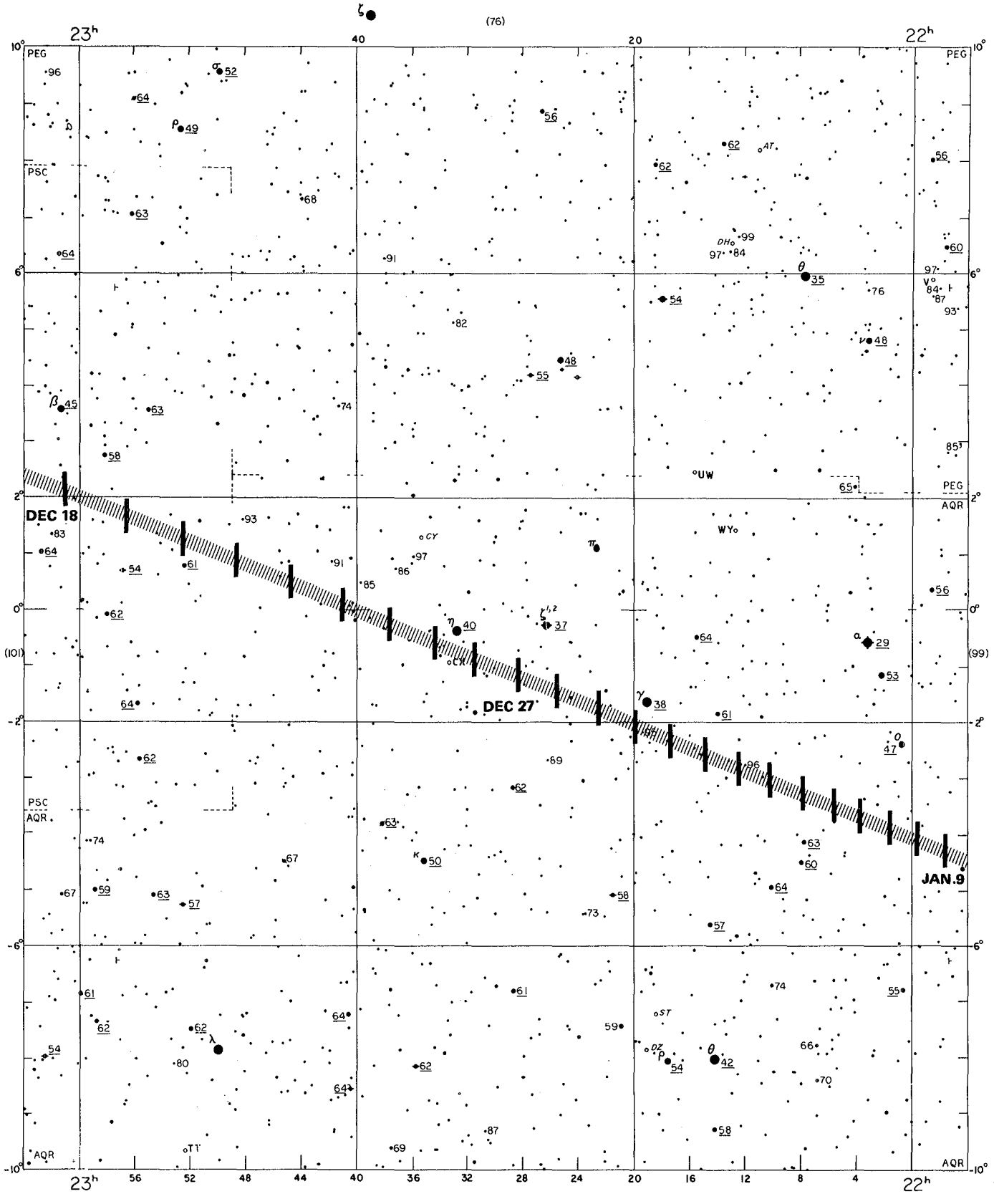


CHART 101



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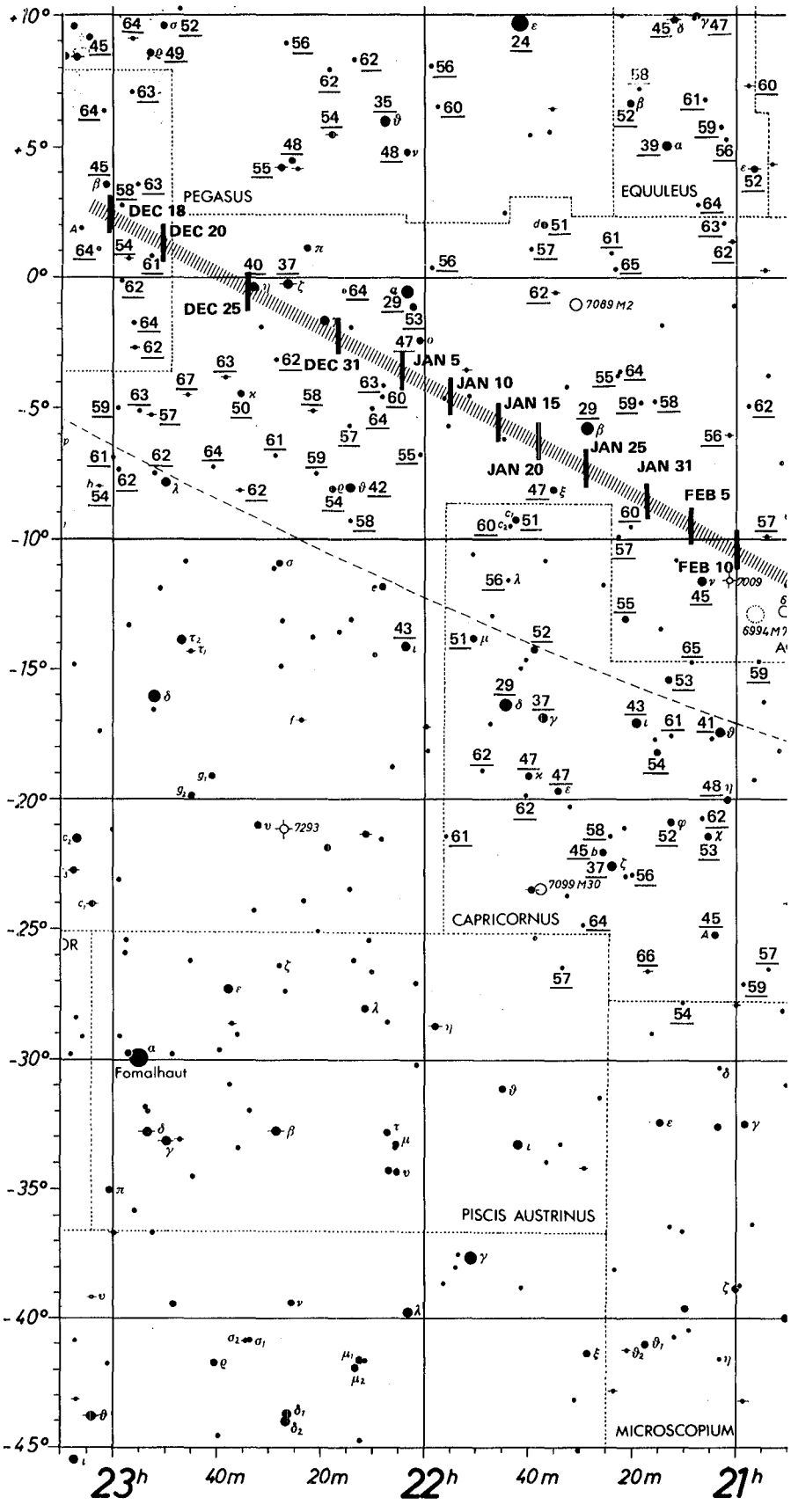

CHART 4A

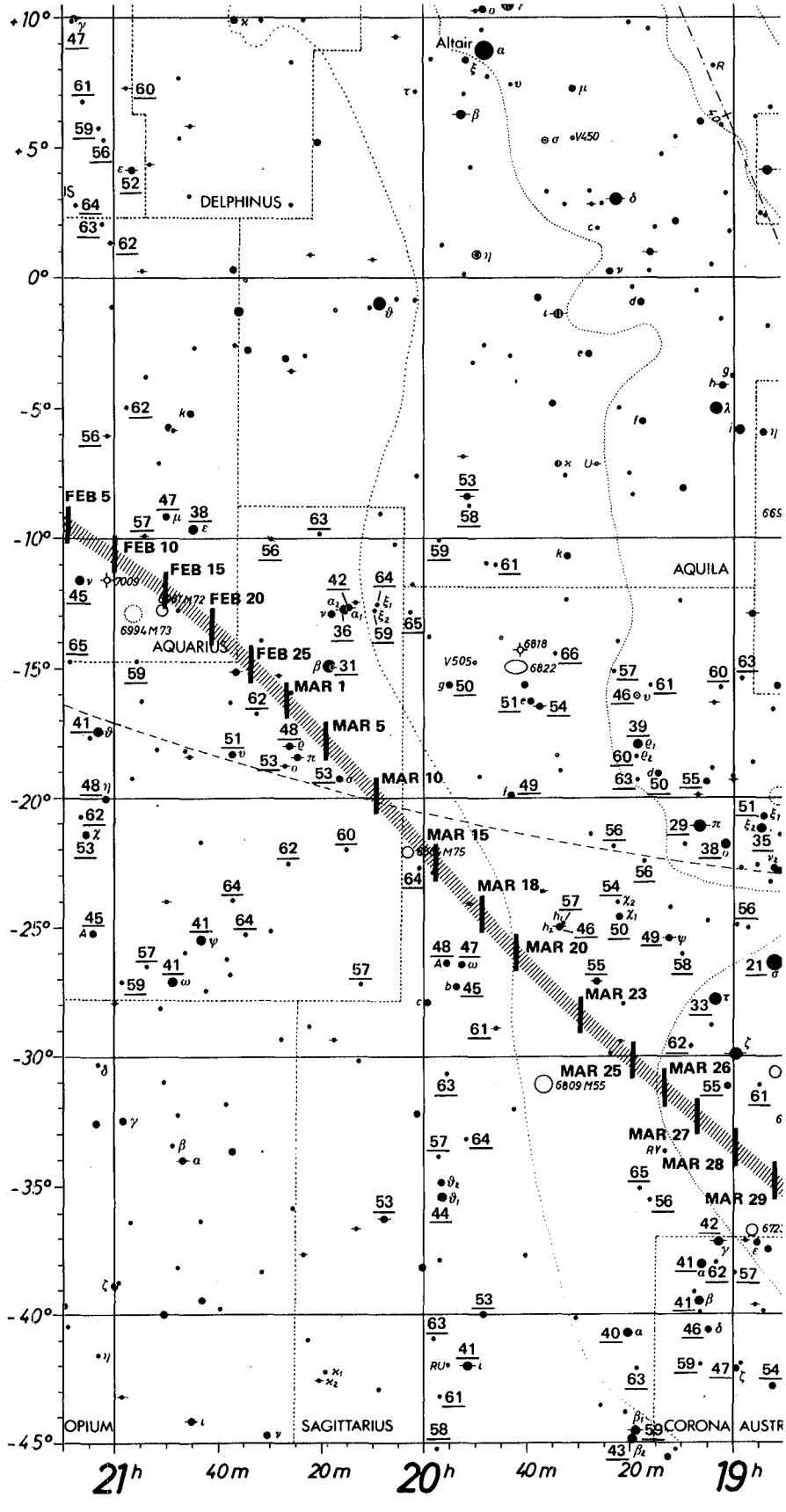

CHART 4B

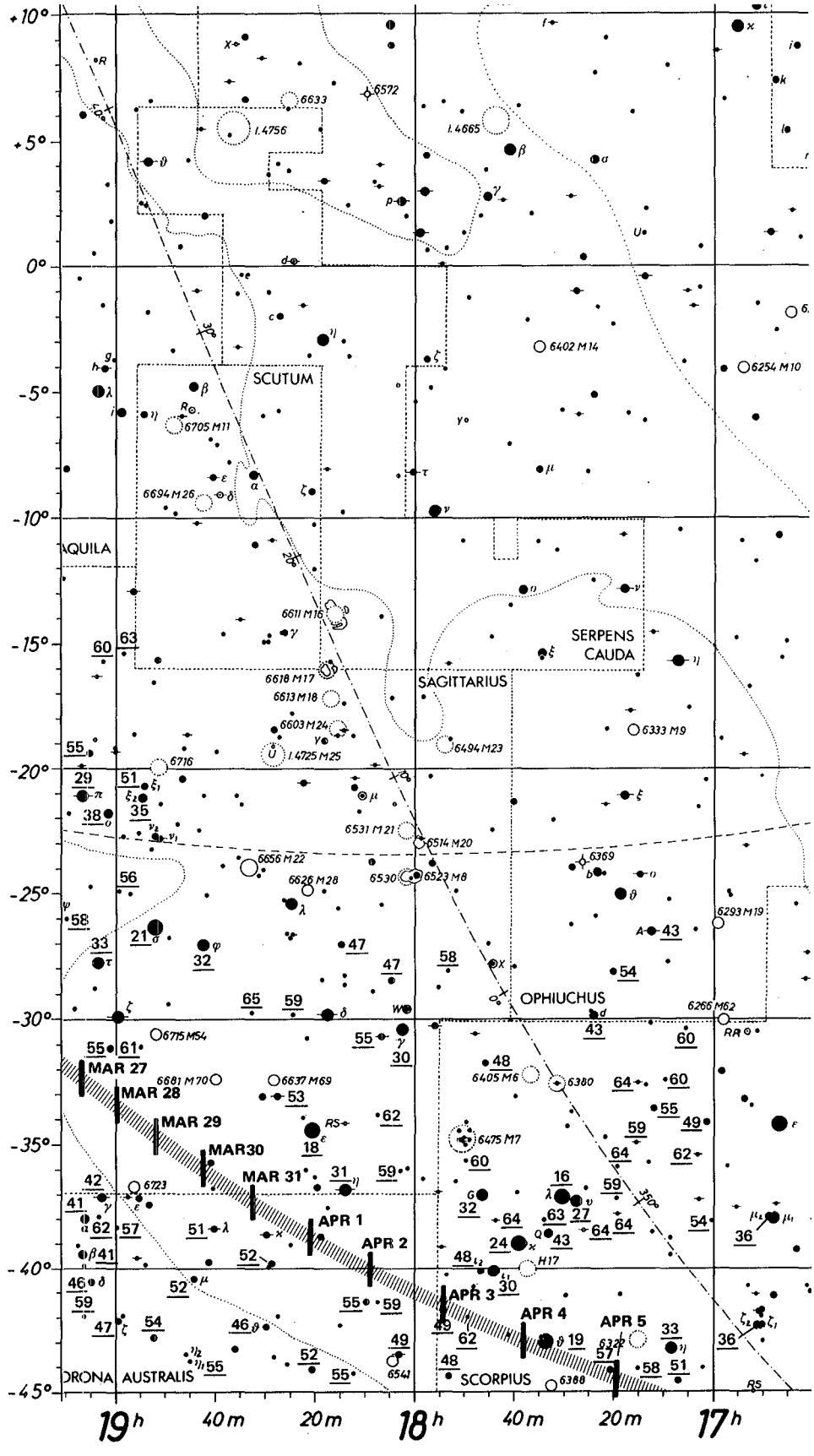

CHART 4C

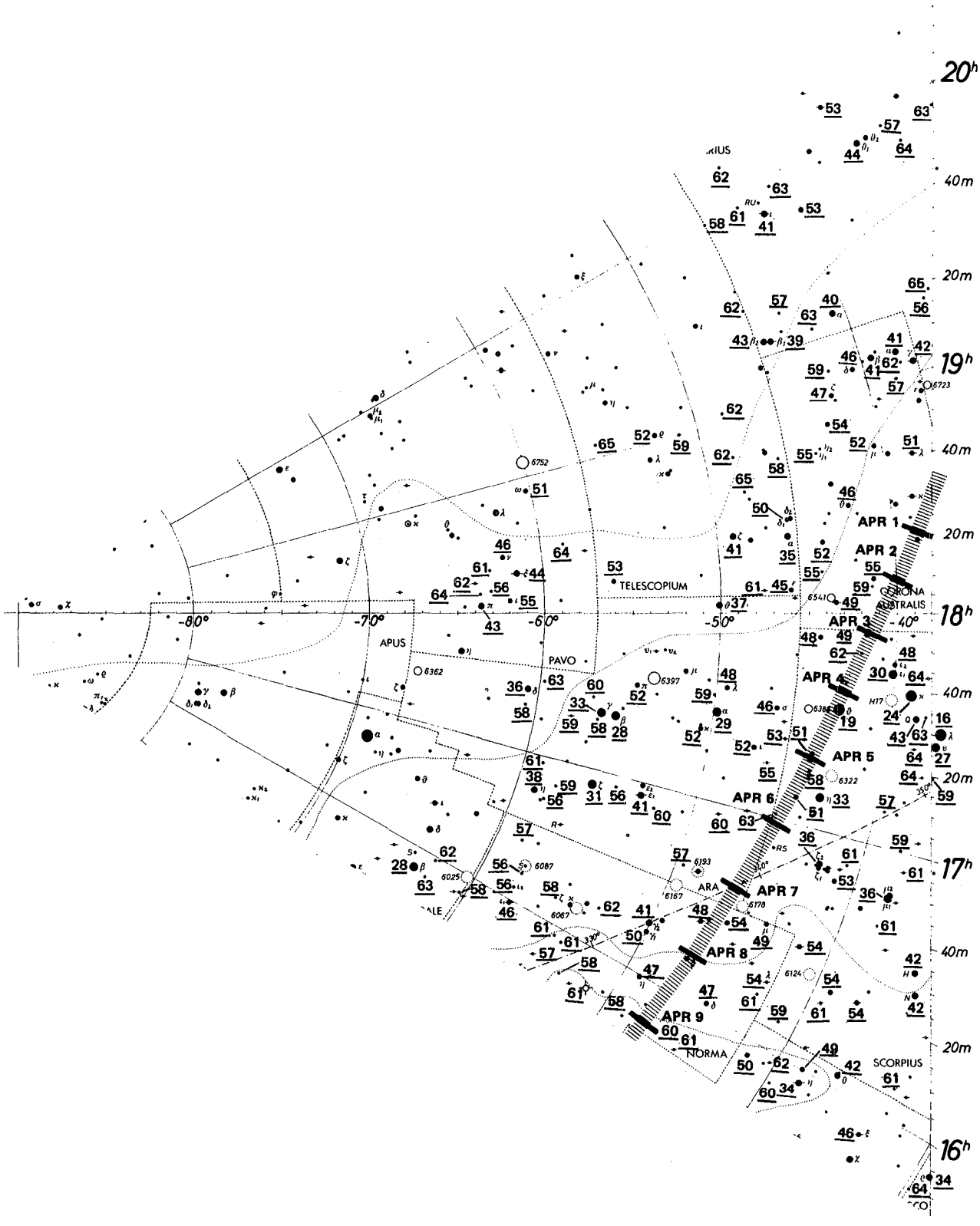

CHART 5A

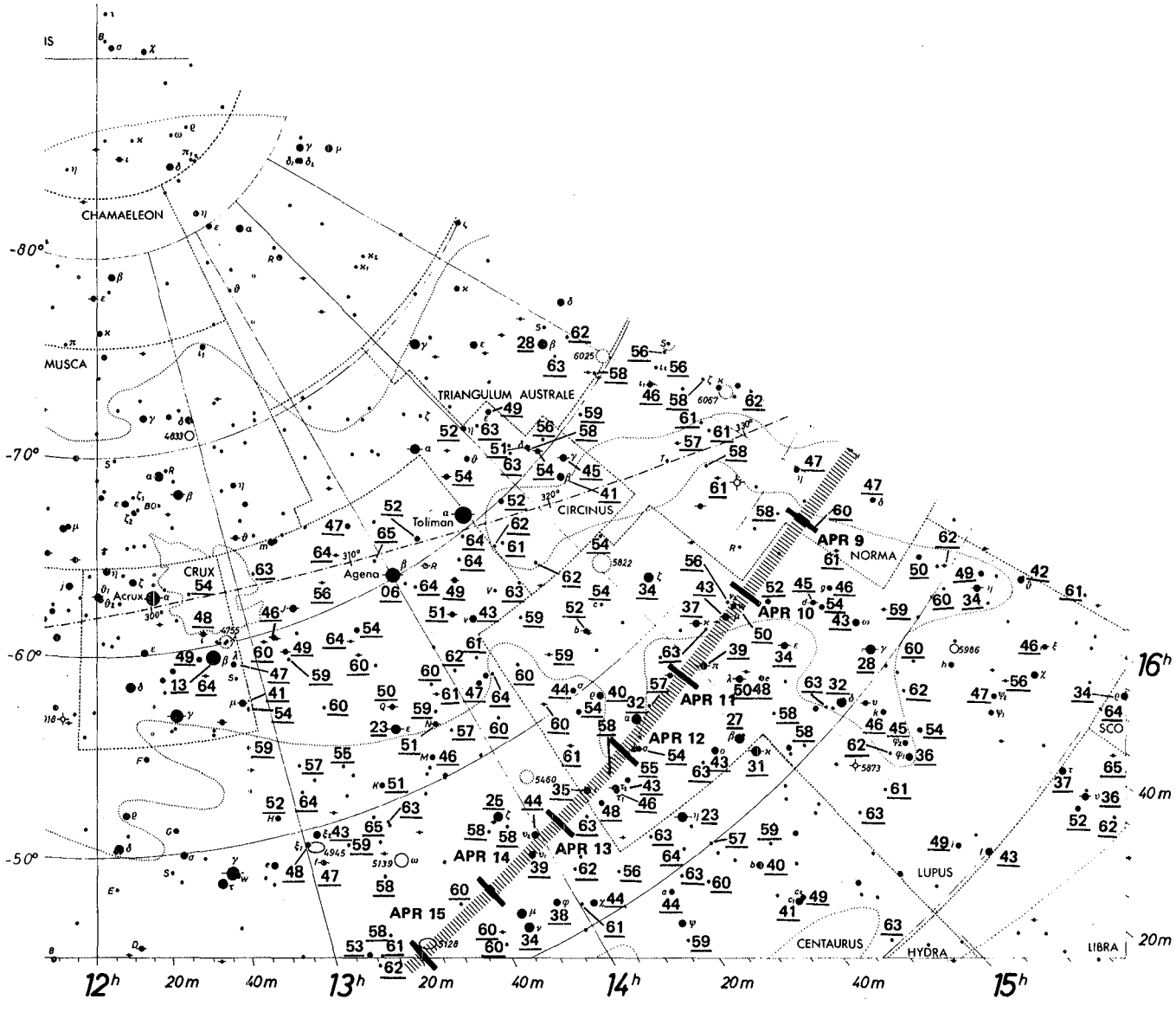

CHART 5B

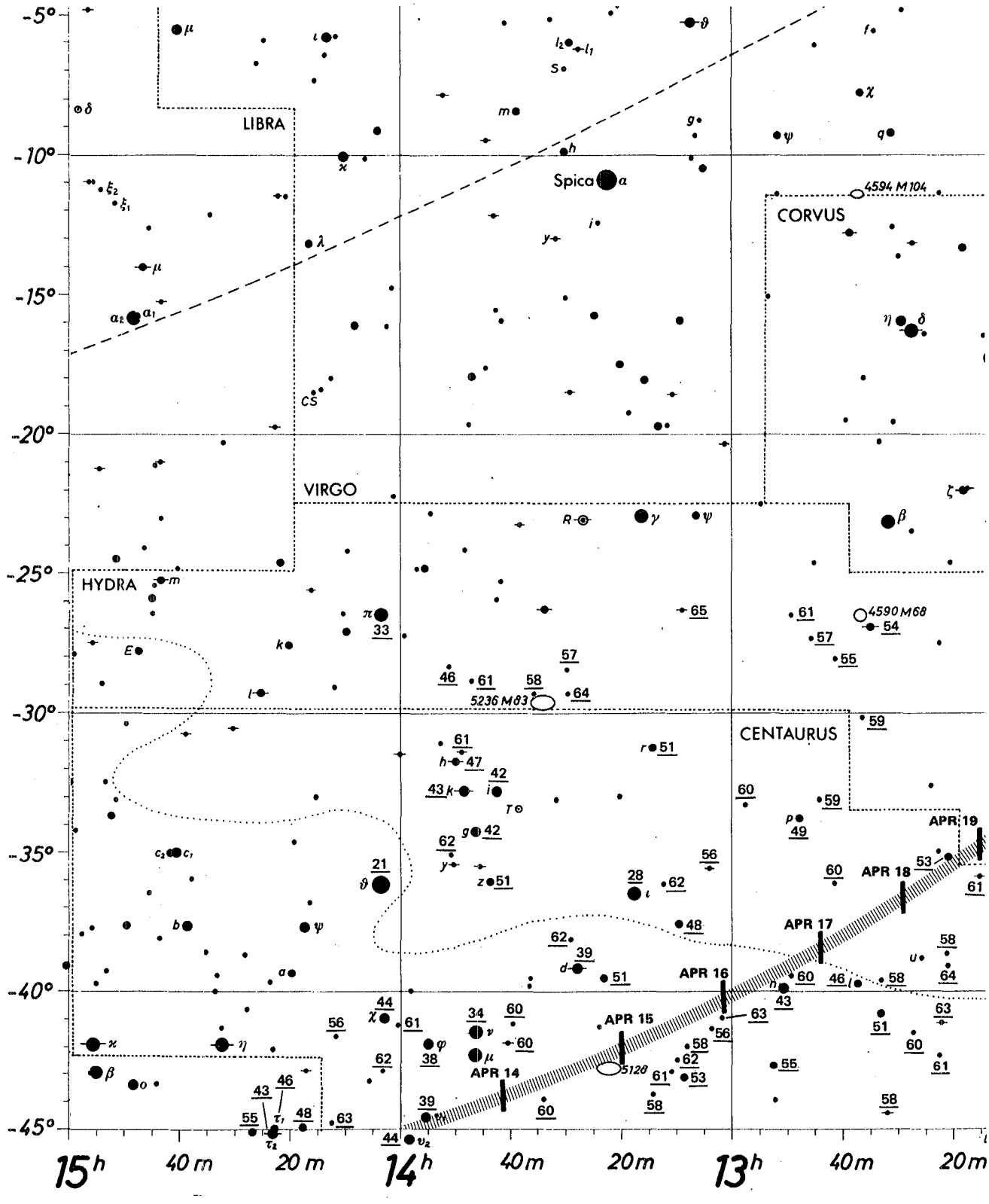

CHART 3A

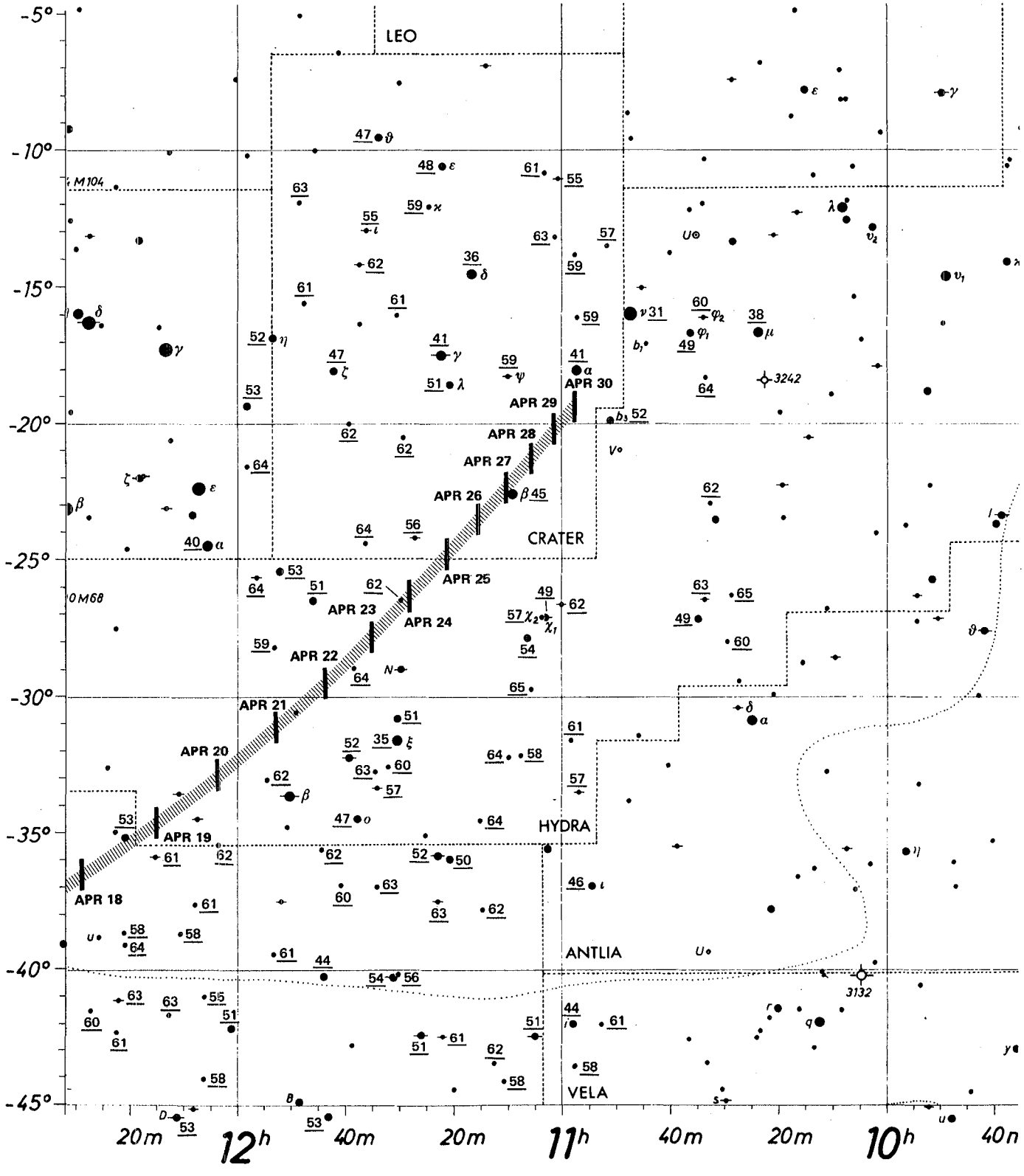

CHART 3B

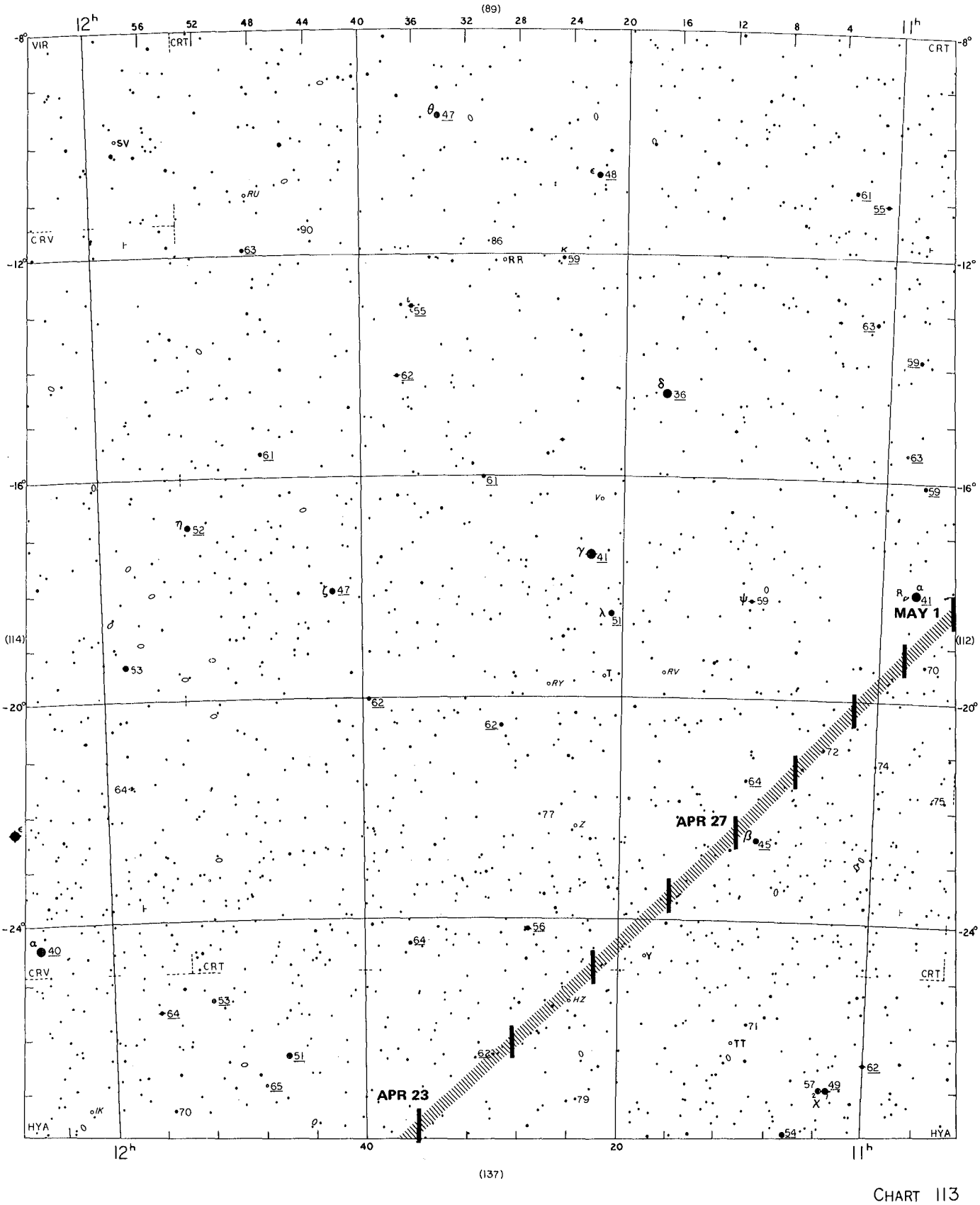

CHART 113

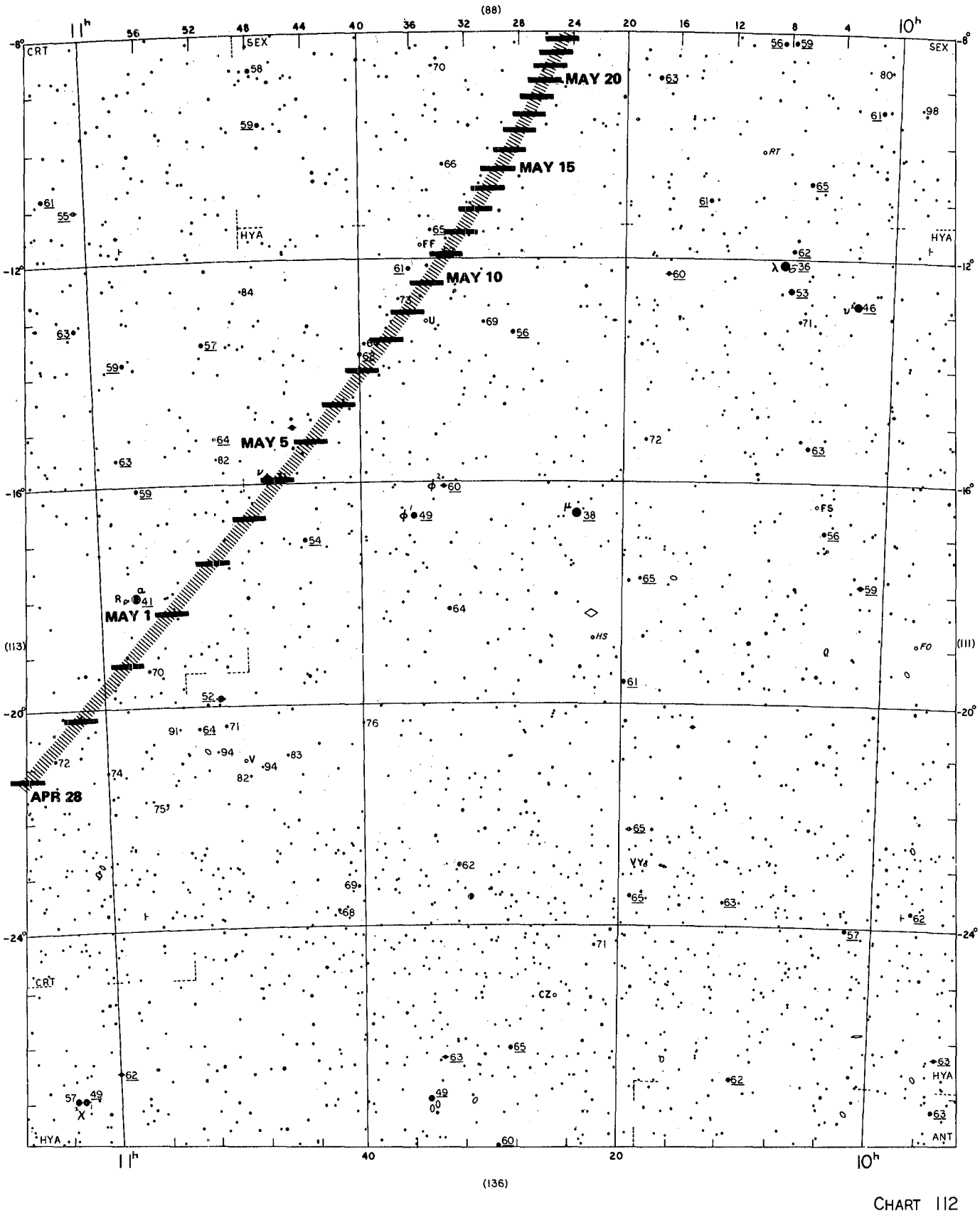

CHART 112

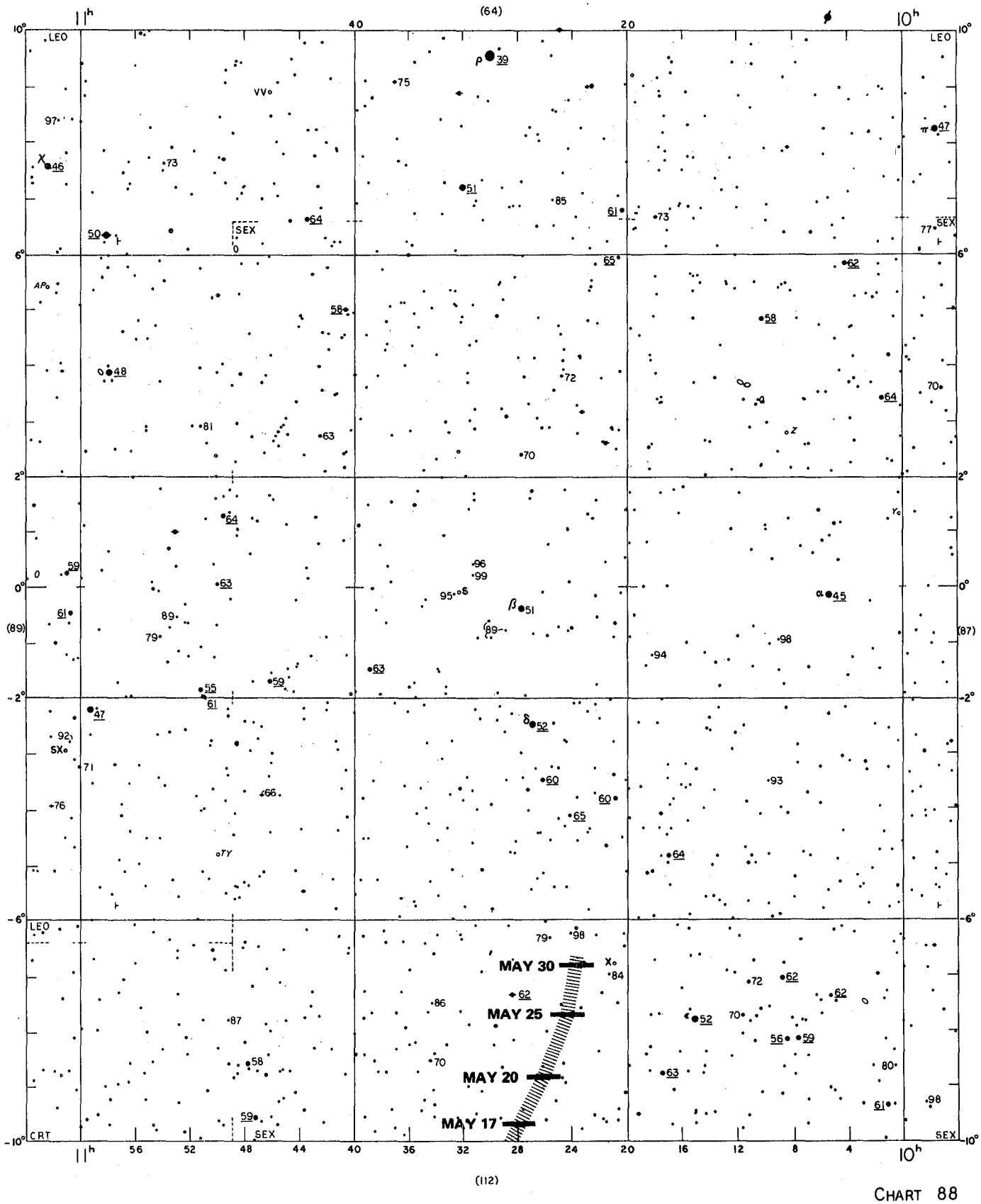

CHART 88

4. CALIBRATION AND STANDARD STARS

STANDARD STARS FOR IHW PHOTOMETRY

TABLE 4-1

Primary Equatorial Flux Standards

Star Identification

HD	Other	R. A. 1950	Dec.	V Mag.	B-V	Spectrum
		h m s	° ′ ″			
3379	53 Psc	0 23 47.7	+ 14 57 24	5.88	-0.15	B2.5IV
26912	μ Tau	4 12 49.0	+ 8 46 07	4.27	-0.07	B3IV
52266	BD - 5° 1912	6 57 53.9	- 5 45 21	7.23	-0.01	09V
74280	η Hya	8 40 36.7	- 3 34 46	4.29	-0.20	B4V
89688	(RS) 23 Sex*	10 18 27.1	+ 2 32 31	6.68	-0.09	B2.5IV
120086	BD -1° 2858	13 44 44.2	- 2 11 40	7.89	-0.18	B3III
120315	η UMa	13 45 34.3	+ 49 33 44	1.86	-0.19	B3V
149363	BD -5° 4318	16 31 47.9	- 6 01 59	7.80	+0.01	B0.5III
164852	96 Her	18 00 14.7	+ 20 49 56	5.27	-0.09	BV3
191263	BD +10° 4189	20 06 15.1	+ 10 34 44	6.33	-0.14	B3IV
219188	BD +4° 4985	23 11 28.0	+ 4 43 29	6.9	-	B0.5III

* Although it has a variable star designation, several more recent investigations find $\Delta m < 0^{m}.01$.

TABLE 4-2A

Primary Solar Analogs

HD	Other	R. A. 1950	Dec.	V Mag.	B-V	Spectrum+
		h m s	° ′ ″			
28099	Hyades - vB 64	4 23 47.7	+16 38 07	8.12	+0.66	G6V
29461	Hyades - vB 106	4 36 07.6	+14 00 29	7.96	+0.66	G5V
30246	Hyades - vB 142	4 43 38.9	+15 22 59	8.33	+0.67	G5V
44594	HR (YBS) 2290	6 18 47.1	-48 42 50	6.60	+0.66	G2V
105590*	BD -11° 3246	12 06 53.2	-11 34 36	6.56	+0.66	G2V
186427**	16 Cyg B	19 40 32.0	+50 24 03	6.20	+0.66	G5V

\+ Spectral types are from various sources and apparently indicate diferences in the classifiers rather than in the stars.

* Brightest member of a triple system; $8^{m}.9$ and $9^{m}.1$ companions at ($1^{s}.6$ E, 4" N) and ($0^{s}.5$ W, 22' S).

** Fainter member of a double system, 6^{m}. companion at (3^{s} W, 28" N).

From Hardorp (1982 A&A 105, 120 and references therein).

TABLE 4-2B

Other Solar Analogs

Star Identification HD	Other	R.A. 1981 h m	Dec. ° ′	V. Mag.
--	SAO 120107	13 46.0	+ 6 07	9.26
120528	SAO 28894	13 48.0	+53 20	8.55
144873	SAO 65083	16 06.0	+34 09	8.84
--	+15° 3364	18 06.5	+15 57	8.64
191854	SAO 49262	20 09.6	+43 53	7.43

TABLE 4-3

Faint Equatorial Solar Analogs

Landolt #*	V Mag.	Spectrum	R. A. 1975 h m	Dec. ° ′
92-433	11.65	G2	0 55.6	+0 53
93-241	9.39	G2	1 54.0	+0 29
94-293	7.02	G5	2 54.0	+0 20
95-236	11.48	G2	3 54.9	+0 04
96-393	9.66	G1	4 51.2	-0 00
97-249	11.74	G2	5 55.8	+0 01
98-313	11.07	G0	6 51.5	-0 34
99-358	9.59	G3	7 52.7	-0 18
100-289	9.13	G7	8 52.5	-0 27
101-057	11.58	G3	9 56.8	-0 54
102-1081	9.91	gG2	10 55.8	-0 05
103-487	11.84	G3	11 53.9	-0 15
104-335	11.70	G3	12 41.1	-0 25
105-257	9.14	G0	13 37.1	-0 52
106-1146	9.10	dG2	14 42.5	+0 09
107-469	12.17	G0	15 38.4	-0 22
108-1911	8.04	G3	16 36.5	+0 06
109-381	11.71	G0	17 42.9	-0 20
110-529	11.41	G0	18 42.7	+0 25
111-1342	9.22	gK2	19 36.0	+0 13
112-636	9.85	G3	20 40.3	+0 11
113-459	12.13	G0	21 40.0	+0 36
114-651	10.28	G2	22 39.9	+0 55
115-366	12.11	dG3	23 43.0	+0 53

* c.f. A.U. Landolt, 1973, AJ 78, 959.

TABLE 4-4

Suggested Spectroscopic Calibration Stars

Star	V Mag.	1980 R.A. h	m	Dec. °	'	Name
β Ari	2.65	1	53.6	+20	43	Sheratan
β Tri	3.00	2	08.4	+34	54	
γ Cet AB	3.48	2	42.2	+03	10	
β Eri	2.79	5	06.9	-05	06	
β Aur	1.86	5	58.0	+44	57	Menkalinan
α CMa A	-1.47	6	44.2	-16	42	Sirius
δ Vel AB	1.95	8	44.2	-54	38	
ι UMa A	3.12	8	57.9	+48	07	
β Car	1.67	9	13.0	-69	38	Miaplacidus
β UMa	2.37	11	00.6	+56	30	Merak
β Leo	2.14	11	48.0	+14	41	Denebola
γ Cen AB	2.17	12	40.5	-48	51	
ζ Vir	3.37	13	33.7	-00	30	
α Lib A	2.76	14	49.8	-15	54	Zubenelgenubi
γ Tr A	2.89	15	17.1	-68	36	
α Cr B	2.23v	15	33.8	+26	47	Alphecca
η Oph AB	2.43	17	09.3	-15	42	Sabik
δ Her	3.14	17	14.2	+24	51	
α Lyr	0.04	18	36.2	+38	46	Vega
ζ Sgr AB	2.61	19	01.3	-29	54	
ζ Aql A	2.99	19	04.5	+13	50	
α Aql	0.77	19	49.8	+ 8	49	Altair
β Pav	3.45	20	43.2	-66	17	
δ Cap	2.92v	21	45.9	-16	13	
α PsA	1.15	22	56.5	-29	44	Fomalhaut

Adapted from the RASC Observer's Handbook 1982

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